JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. CXVI., No. 2537.——TUESDAY, DECEMBER 26, 1911.

1911

A Retrospect.

THE year has been one of strange and strong contrasts—meteorologically, politically, and in the labour spheres of industry. In the summer, we had a spell of continuous brilliant sunshine and high temperatures, the like of which had almost faded (through remoteness) from the memories of residents in the British Isles. At other parts of the year, the alternations of bright, muggy, and cold weather—dry one hour, the next heavy rain—have been sharp and incompatible with health and physical comfort. We have had the festivities and gorgeous ceremony of the Coronation; we have had strikes, our food and other supplies threatened, our means of transit sadly interrupted, rioting in the South Wales coalfield, and a threat to cut off winter supplies of coal. We have had all the pageantry presented to us, in print, of the Royal visit to India, and have rejoiced loyally. We have had, on the other hand, the trouble between Germany and France (now happily composed) in regard to Morocco, and in connection with which the position of this country appeared at one time to be drifting towards a serious interruption of friendly relations with Germany. There has been the war in which Italy and Turkey are involved in Tripoli; and there has been the insurrection in China. As we say, the year has been one of strange and strong contrasts.

Parliament too has had a stormy period; and a long and anxious one for all concerned—not only on account of the densely black foreign clouds, but in regard to matters domestic. Parliament commenced work betimes (on Feb. 6), and continued with short holiday breaks, and a period for the Coronation celebrations, until the third week in August. Then the position of affairs was such that an autumn session was called for; and on Oct. 24, members reassembled, and continued work until Saturday, Dec. 16. Only a comparatively few public measures have been entered in the Statute Book; and of these those of most importance are the Parliament Act, which reduces the power of the House of Lords, the Coal Mines Act, which intends to give greater security underground to the workers in the coal-fields, and the National Insurance Bill, the passing of which in its present form has, irrespective of political creed, aroused indignation and opposition throughout the length and breadth of the land, and in a manner that is without parallel in modern legislative work. The workers of various gas companies, who are entitled to sick benefits equal or superior to those proposed under the measure, and at less cost, tried to obtain exemption from the Bill, but failed, though Government and municipal employees, and the clerical staffs of large companies where benefits equal to those to be conferred by the Act are assured, are allowed exemption. It has been a parliamentary year of extraordinary turmoil, mainly brought about by the large projects of social reform to which the Government have set their hands, and which, by present appearances, will, if carried farther, produce such an ill-effect upon industry that the "reform" will recoil upon the worker in a fashion that the reformers gaily ignore, or of which they have altogether lost sight.

The trade of the year has been of quite a respectable order, coming upon the excellent year 1910. During the eleven months for which we already have the figures, the imports, have amounted to £615,674,630, or an increase on 1910 of £6,353,717, and the exports have aggregated £415,710,581, or an increase of £22,544,880; while the re-exports have amounted to £94,040,950, or an increase of £141,465. In other words, the imports have increased 1·04 per cent.; the exports, 5·73 per cent; and the re-exports, 0·15 per cent. In relation to trade, a Royal Commission, it is announced, is to be appointed shortly to inquire into the natural resources and improvement of the trade of the Empire. "May it," said the King in his speech when proroguing Parliament, "be fruitful in showing the means "of ensuring the greater prosperity, and promoting the "mutual intercourse, of my Dominions." With so many political factors—home and foreign—to unhinge confidence, so many industrial disturbances, temporary, but still threatening and uncertain, to undermine otherwise prosperous conditions, it is not to be marvelled at that the Stock and Money Markets enjoyed comparatively little tranquillity. At one time towards the end of the summer Consols touched as low as a fraction over 76; but they have recovered somewhat, though not to the figure at which they stood early in the year. About the end of March they were marked at upwards of 82; and at the time of writing, they are a fraction above 77. A bright spot has been the Gas Market. From the commencement of the year, its strength has been pronounced, and, even when transactions have not been extensive, the utmost steadiness of prices has prevailed. This indicates the views of the public upon the value of gas stocks as an investment. Most of the quotations in our list show an accretion of value—those that have receded are few in number and the recessions unimportant in degree, or in one or two cases where there is a difference on the wrong side there is an explanation. But, generally, prices are higher. Gaslight and Coke stocks are practically the same as at the beginning of the year; and South Metropolitan and Commercial have improved somewhat. Bromley stocks have put on much flesh in regard to value in view of the prospective amalgamation with the South Suburban Gas Company. Sheffield and Portsea Island stocks have made remarkable bounds upwards; while, among suburban stocks, Ilford and Tottenham have added well to their value. The stocks of British companies working on the Continent are practically the same; and so are companies operating at a distance—San Paulo and Cape stocks being an exception. For the former we cannot account; but it is easier to do so for South African gas stocks, when the history of the past few years is considered. But more on this point presently. With regard to sales of gas stocks, we prefer that Messrs. A. & W. Richards should speak from their intimate experience. They tell us that they have disposed of large amounts of capital at their periodical auction sales. These have been held throughout the year; and the results which have been recorded from time to time bear witness to the keenness of the gas investor to acquire stocks whenever they come into the market. New issues have been made for a number of the principal London Suburban Companies as well as for many provincial concerns, and executors and other private owners have, to a considerable extent, utilized the medium of the hammer for realizing their holdings to the best advantage. The prices for ordinary stocks have been well maintained throughout the year; but less disposition to absorb debentures has again been in evidence. With this exception, however, the figures compare favourably with those ruling during the preceding twelve months.

A REMARKABLE COMMERCIAL YEAR.

The strength of gas securities in the Money Market is fully justified by the year's trading of the industry. If the second half of the year has generally, as we know in certain instances it has done, continued (with the modifications that the second half usually shows as compared with the first) the experiences of the first half, then it will have been altogether a remarkable year. The tale for the first half year was an extraordinarily agreeable one; but we can hardly say, with the thermometer standing so high for a continuous period during the summer, what effect this may have had upon the domestic consumption. But we know that the hot weather gave many gas undertakings a fresh spurt in the fixing of gas-cookers; so that, with the alternately wet and cold weather with which the winter has opened, though the temperature has not been so continuously low as gas suppliers prefer who are looking for a good heating load, there are sound reasons for hoping that the close of the half year will find the consumption of gas well exceeding

that for the corresponding half of 1910. If this should prove so, it will have been a conspicuously good year.

We have said that the first half of the year was a remarkable one. From all over the country the same tale came. Financial success and stability were marked everywhere. The Governor of the Gaslight and Coke Company (Mr. Corbet Woodall), the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter), the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), those of the Suburban and Provincial Companies, and the Chairmen of the Gas Committees of Corporations and District Councils all had the same tale to tell. But it was to say the least a unique tale; and it emphasized, in a more forcible manner than ever, the changing circumstances of the gas industry. With all competition, the experiences attested that its vitality was never higher, its financial position never stronger, and its prospects never brighter. But there must be a care. The very position of the industry to-day adjures us to look forward and not backward, to keep an eye on all the forces opposed to the industry's progress, and to lay our plans with deliberation, foresight, and wisdom, to meet and attack those forces. We look on the published records of the year not as something normal in the industry's position, but as abnormal. Yet we may take them as a standard to which to work, and to endeavour to exceed.

The profits came out in good form. What were the contributory causes? Increased consumptions were general; but it is increased gas consumption at lower prices than used to rule. Yet profits are higher. The secret is found in the manufacturing and commercial administration, and in indulgent markets. From every quarter came the intelligence that though coal during the year ending June last had been rather higher in cost than during the contract year 1909-10, the revenue per ton of coal carbonized was better. More gas was made per ton of coal, through the increased application of heavier charges and longer duration carbonization; and consequently the sales were greater per ton. Capital, labour, and other charges per 1000 cubic feet declined by those, in themselves, infinitesimal fractions that in the bulk make for substance. Consumers increased, and applications of the use of gas spread. From various causes, everyone of the markets for the secondary products was in good form, and excellent prices were secured. Coke stocks in most cases shifted off; and, in some instances, there was an absolute dearth of coke reported, so good was the demand. Tar likewise sold well, through the growing request for it for road purposes. The application in this direction is extending bountifully. Those who a few years ago pointed, with sanguine spirit, to this as a prospectively profitable outlet have had their early views vindicated. The Road Board and road authorities all over the country have given this application encouragement; and the *vox populi* has clamoured for the relief that it gives them from a noxious nuisance. The road authorities, too, are not only looking upon tar as an abater of a nuisance, but as an important factor in the science of road economy. Sulphate of ammonia also did well. We will deal further with residuals presently. But it will be seen that there has been during the year a favourable combination of circumstances which has given to the home gas industry the financial strength shown by its last-issued accounts, and which has enabled it not only to fortify its reserves and spend on maintenance and depreciation with reasonable freedom, but to look well after the interests of the consumers by reducing charges, and to pay the holders of gas stocks and shares higher dividends.

The question naturally arises as one gazes upon this position, What are the prospects? A retrospect is hardly the place for making a forecast. But the conditions of the year now coming to a close must bear upon the prospects of the industry. The reductions in price that have taken place will facilitate the broadening of the base of the industry's operations, and increase the popularity of gas as a cheap and economical lighting and heating agent. The uses of gas continue to expand; and the industry is combining —or rather a section of the industry has combined—in a national campaign to educate the public in these matters, and to defend its commercial interests. Higher efficiency inverted gas burners and lamps continue to come upon the market. More consumers, more cooking-stoves, gas-fires, water-heaters, and a more extended industrial application of gas are all standing to the credit of the gas industry. The day load continued to increase—in some places corresponding, taking the year through, to the night load. We heard from Blackpool, indeed, that the day load is now heavier than the night load. The coal contracts entered into in the early part of the year for the current year were at a somewhat lower price than the year before; and oil was also at easy figures. The residual markets show signs of continued firmness. Tar especially has, despite increased production, good prospects of absorption in future for road purposes; while tar distillers are better satisfied with the product of modern carbonization methods in view of the lessened free carbon in it. So, considering the position, there is ample justification for a buoyant hopefulness as to the future.

If there were any occasion to further supplement these evidences as to the prospects, the last census of the population, the returns under the Census of Production Act, and the Board of Trade returns might all be referred to. But we will content ourselves by pointing out that the last census of population indicated that in England and Wales the population had increased by 3,547,426 to 36,075,269, which means a greater scope for business. The migratory tendency of the population in and about London, however, is shown by the fact that, in the Administrative County of London, the population has decreased by 13,306; while in Greater London the increase has been 671,561. This partially discloses the reasons for the excellent returns from the gas companies operating in London suburbs. It also indicates the prudence of the policy of the Gaslight and Coke Company in annexing more open territory on their boundaries. We cannot omit to mention as among the good signs affecting the future the increased facilities for the cultivation of the men required to take the official helms of the gas undertakings of the country. One cause of this is to be found in the enhanced opportunities that the operations of the industry themselves offer for the exercise of talent, and the fact that, opportunity offering, there are the men to grasp it. The only dull spots that we see to the bright picture are the increased charges that threaten industry everywhere. The cost of living is greater; wages are higher. The social reforms of late years of the present Parliament have brought additional burdens on undertakings generally; and through national health and unemployment insurance, certain extra charges are coming upon commercial enterprise and the community generally, even though, in the case of health insurance, the benefits are secured—and more than secured —in several quarters, notably in many gas companies. The London Gas Companies and those who use the Port of London have also to pay the new Port of London dues on their incoming and outgoing materials.

Reductions in the price of gas have been spoken of. But there are some extraordinarily low ones ruling in this country to which special reference deserves to be made. We have Widnes now charging the ordinary consumers 1s. 1d. per 1000 cubic feet, large consumers 11d., users for motive power 9d., and giving prepayment consumers 54 cubic feet of gas for 1d. The Sheffield Gas Company are treading hard on the heels of Widnes, with prices of 1s. 3d., 1s. 1d., and 11d. according to consumption, as well as 11d. for engines and for the public lamps. Plymouth is down to 1s. 7d.; Wandsworth to 1s. 9d., and, with discount, gas-engine users are obtaining their gas at 1s. 5¾d. From numerous places have come announcements of reductions from 1d. to even 5d. The gas industry is so ordered that it must share its good fortunes with the consumers, if—in the case of the sliding-scale companies—there is a desire to enjoy higher dividends. Gas prices were never lower than they are to-day; and this is mainly due to circumstances other than those produced by competition. Where old prices have been nursed, until competition has forced the companies to yield, we have little sympathy with the concerns. But they are of the few; the many believe in the business development aid of low-priced gas. A good deal of attention has been paid during the year to the charges to slot-meter consumers; and concessions have been properly and freely made.

Looking abroad, the tale of the gas industry was bright. From all quarters but one beyond our shores where British capital is employed in gas supply (and in the fortunes of the concerns we are, therefore, especially interested), there came reports similarly good to those at home. From Germany, France, and other Continental countries, South America, Australia, the Far East, and India, good accounts reached us. The one black spot was South Africa, through municipal competition in electricity, and the drawback of expensive coal for gas-manufacturing purposes. But there are signs even there of improved circumstances. The Imperial Continental Gas Association are winding up their Vienna affairs.

The same concern report a curious experience. Coke was a bit of a drug with them; but owing to the exceptionally hot summer, the waterways—the chief means of transport for fuel—became depleted, and the fuel dealers in Berlin and at other centres of their operations became large purchasers of coke, and so relieved the Association of their excess stocks. Among other commercial trading undertakings in which we are interested, is the Welsbach Company. A good scheme of reconstruction in connection with it was carried through during the year. A report was made by the South Staffordshire Mond Gas Power and Heating Company that the number of their consumers had increased from 96 to 111, and that the profit on revenue account was £4228. The progress of the concern measured by the past is regarded as satisfactory; but it is slow.

Coalite.

We will not dwell at length on the position of the Coalite Company. It lingers now in memory chiefly as an over-blown bubble that Time has pricked. The year has seen the affairs of the Syndicate and the British Company sink almost into nothingness. In the early part of the year, time was occupied in clearing out of the various stations in which the British Company had established themselves; and the Barking station represents the remnant of the effects of this concern that set out—under the guidance of City company promoters—to revolutionize the world, and to provide a new and luxuriant gold mine for investors. But even so, the early part of the year saw the Directors in office still hopeful of something being done at Barking. The plant, with every new experiment and every resulting change, has assumed more and more the form of an ordinary gas-works plant. Then a new and mysterious temperature point was ascertained, which was going to do the trick. Professor Lewes, however, would tell the Coalite people there is no critical temperature point applicable (for manufacturing coalite) to all classes of coal. But the winter has come, and is well advanced; and no one hears of any remarkable business proceeding between Barking and the coal-cellars of consumers. The end of this enormous piece of folly, against which many experienced carbonizers issued a warning as to commercial failure, must surely soon come. If there had been any hope of saving something for the deluded shareholders from the application of the new mysterious carbonization point, the glad tidings would have been circulated before this.

Company Wreckage.

The year has seen the further breaking up of the groups of companies promoted under the auspices of the men Preston and Eaton. Preston has been making the acquaintance of the Bankruptcy Court; and one of Eaton's figure-heads for directorates, and a participator in the latter flotations of that prolific promoter—Sir C. Herne Soames—has also been the principal actor in bankruptcy proceedings. Several of the companies were before the Courts, and the deception practised on the public has been time after time exposed. In connection with the Ticehurst and District Water and Gas Company, Mr. Justice Warrington described the proceedings of Eaton and one of his satellites, Dr. White, as "gross acts of misconduct and misfeasance," and declared them guilty of a breach of trust. The management of this Company, like that of other of the companies, has been taken over by new Boards of Directors appointed by the plundered shareholders. In some cases committees of investigation and official receivers have been appointed. To illustrate how these concerns have been over-capitalized, the case of the Bucks and Oxon Company may be taken. The Secretary and Directors valued the assets at £45,000; while Mr. Frank H. Jones appraised them at £18,000—a difference of £27,000; There has been some wicked and cruel robbery of the public through these companies; but fortunately gas company promotion is not considered a good line nowadays, unless their *bonâ-fide* character is attested by the names of men of good repute in the gas industry. We believe that, excepting the resuscitation of old concerns, the only new Company that during the year did not appeal to us as being capitalized in a manner having proper relation to the business done was the Weald District Gaslight and Coke Company.

Municipal Gas Profits.

The financial results of the trading of municipal gas concerns during the year have been, as already intimated, similar to those of company undertakings. But the question of how the profits should be disposed of has been one that has been the subject of considerable and sharp discussion. No one recognizes better than those who are immediately entrusted with the management of such concerns how iniquitous is the policy of appropriating profits in subsidizing the local exchequer. The policy has not a single sound principle to support it. People are increasingly recognizing that the old argument that the ratepayers are financially responsible for the undertaking is played out. In some towns, the ratepayers have already received, through profit appropriation, more than the whole of the outstanding debt on the gas concerns, and yet have never been called upon for a penny piece. If a gas undertaking happened to incur a deficiency, the way of the local council to adjust matters would be——not, as will the local electricity concern, to compulsorily make the ratepayers render assistance, but to raise the price of gas to the necessary degree. The fallacy of the reasoning of profit-taking councillors, the iniquity, the inequality of the whole proceeding, have been further presented by the discussions of the year. Representatives of the Manchester Corporation Gas and Electricity Committees held conferences, and came to the conclusion that, if the Council appropriated in aid of the rates 1 per cent. on the outstanding capital, they ought to be well satisfied; but the Council have not seen fit yet to endorse this.

As a matter of fact, Parliament has, by its proceedings in the case of Salford (which was never consummated through the retreat of the Corporation from the temporary reach of Parliament), Oldham, Glasgow, Kirkcaldy, and the Potteries, thrown a series of bombshells in the camp of the municipal traders; and, at the moment, they are in a state of consternation. The Salford Corporation are approaching Parliament again in the coming session; and the Eccles Corporation and the Swinton, Pendlebury, and Worsley District Councils have taken the necessary steps to obtain a straight verdict from Parliament on this occasion, by promoting a Bill also giving the Salford Corporation the powers they require, as well as securing for the gas consumers and out-districts the protection that Parliament gave them in 1909. This move seems to have completely unnerved those who find the policy of profit appropriation seriously assailed; and a number of delegates from important local authorities have taken counsel together, and have promised to support Salford in resisting this attack on the old and much abused privileges of municipal traders. It will be an interesting fight, if allowed to proceed; and all over the country, there is hope among those who have the immediate direction of municipal trading concerns that this Salford fight will help to go a long way towards ending the serious fleecing of gas consumers that has all too long prevailed. We have written "if allowed to proceed," because only a few days ago, Salford was suggesting to the outside authorities that a Provisional Order should be adopted, so as to enable the outer districts to share in the profit plunder.

Competition.

The competition with the gas industry does not grow less keen—from the electrical world, in the residual markets from bye-product recovery coke-ovens and other sources, from suction gas plant makers, and now the Diesel engine. The popularity of the gas-fire has also set the retail coal dealers in opposition. But, with it all, the gas industry thrives; and the competition maintains a degree of vitality and energy in the industry that keeps all engaged from suffering from *ennui*. All competition can be met. The industry is daily shaping its courses in a manner that must strengthen it against its rivals. It has no fear of fair and straight competition. But it objects to the setting-up of municipal concerns, and then directing them unfairly to the injury of longer established private enterprise. The gas industry is not afraid of above-board competition from any electrical enterprise; but it does object to the malicious calumny which is employed in the effort to divert business from it to electrical undertakings. The disgraceful tactics of opponents have been pursued through the year with a vengeance and a disregard of honesty that cannot be tolerated longer. This is not square commercial competition. Though gas is used properly and by modern appliances, the competitors have been trying to persuade the community that the "lethal" qualities of gas are impairing health; and one Medical Officer of a London Borough Council went the length of insinuating that that dread disease consumption was contributed to by products of combustion. The Electricity Publicity Committee carried on their propaganda;

and leaflets were issued that outraged ordinary commercial decency in slandering gas.

The makers of electrical appliances advertised largely, asserting that gas poisoned food, and committed much other evil that experience denies. A scandalous anonymous advertisement appeared in a Manchester paper at the time of the Smoke Abatement Exhibition there, in which gas was seriously libelled; and this brought the newly formed British Commercial Gas Association into the field to perform its first public work in the issue of replies to the detractors. There were also some very peculiar articles written by the "Engineering Correspondent" of the "Daily Telegraph" at the time of the Electrical Exhibition at Olympia, and published in our morning contemporary, in which gas was traduced either directly or by implication. The "JOURNAL" challenged the writer of the articles on all points, with the result that he disclosed, and has since practically acknowledged, that his information was *ex parte* and defective. We are still waiting for his full defence of certain allegations which he has not yet attempted to justify.

Among other indirect methods of attempting to defame gas, was the use made of the report on the Hawes Junction (Midland Railway) disaster, in which, on evidence that was not free from considerable doubt, Major Pringle considered that gas was, at all events, partly responsible for the fire. This was controvertible on the evidence; and it was easy to point to disasters to trains in which electricity has had the leading part. In connection with the subject of train lighting, coal gas for this purpose is coming to the front in place of oil gas.

PUBLICITY AND THE BRITISH COMMERCIAL GAS ASSOCIATION.

All these things insist that there must be systematically worked machinery for dealing with matters of this kind, and, if necessary, to assist in dealing with them in a manner that shall exceed a mere denial through the channels of the press, or in any other ordinary mode of publicity. There must also be methodically worked machinery for educating the community on the newest of devices for securing the best efficiency from gas whether for lighting, heating, or power, and for producing a general flow of knowledge as to the labour-saving methods the gas industry has to offer. The need has been accentuated during the year—not by any falling off of the business of the industry (it has progressed), but through the fierce attacks of competitors, and through the evidence that has everywhere accumulated as to the wide ignorance of the public concerning gas and its uses, which ignorance extends to newspaper writers, and to public officials.

The first month of the year saw set on foot the inauguration of a Publicity Scheme for the gas industry, under the auspices of the Institution of Gas Engineers, aided by the Commercial Sections of the District Associations. Much effort was expended in floating the scheme; and one of the surprising things about it has been the listlessness of such a large proportion of gas undertakings to a need that has developed from new conditions. New conditions have come upon us; yet many administrators still decline to take a broader view, but continue to look at things from the standpoint that applied to past and dead circumstances. A conference on the subject was held last April. The result was promising. A difficulty was found in getting municipal authorities to come in. In this connection, Alderman F. S. Phillips, the Mayor of Salford, and the Chairman of the Gas Committee, did splendid service in convening a conference of the administrators of Lancashire and Yorkshire concerns. Glasgow, Manchester, Salford, Bradford, and other influential Councils supplied a good lead to the municipal authorities; but we regret there have not been more who have given adherence to the scheme. Another general conference was held in London in the autumn; and by this time there had been a remarkable development of the scheme—and a development that supplies a large scope for useful work in guarding and developing the industry's commercial interests. This is the formation of the British Commercial Gas Association, which affords representation in the management of the publicity funds (excepting the percentage to be allocated to the Special Purposes Fund of the Institution) to every class of subscribing undertaking, and to every division of the country—thereby protecting interests. It also supplies the platform for conferences; and the first one, it has been arranged, is to be held next autumn in Manchester. At the conference in London in October, it was stated that the subscriptions to the fund amounted to rather more than £10,700; and since then the Society of British Gas Industries have resolved to raise from among their members £2000—a sum exceeding the prediction of their Chairman (Mr. H. James Yates) at the conference in question. While on the subject of publicity, it may be mentioned that the annual conference of the American Commercial Association disclosed the fact that it has now upwards of 3000 members. The Association has also a publicity proposal under consideration, the financial basis proposed for which is $1 per million cubic feet of gas sold, as against only 2s. 6d. in this country.

The year has not passed without some excellent publicity work having been accomplished prior to the getting into working order of the machinery provided by the British Commercial Gas Association, which appears to be a bigger task than was originally anticipated—largely through gas undertakings not doing their duty promptly. But the idea is to organize the thing well, and to have no going back when once started. But the subject is the publicity work for the year. There has been a fair amount of local advertising done by co-operative and individual means. Many local exhibitions have likewise been held. But prominent shows at places of special attraction have been the combined gas companies' display at the White City (Shepherd's Bush); and the magnificent show of high-pressure gas-lighting at the Festival of Empire Exhibition at the Crystal Palace. The Chairman (Mr. Charles Hunt) and the Directors of the South Suburban Gas Company, together with their Engineer and Manager (Mr. S. Y. Shoubridge) deserve the hearty thanks of the gas industry for their enterprise in securing, in competition with the electricity supply companies, the main lighting of the grounds and part of the Crystal Palace itself, and for the manner in which they carried out their contract. Not only so, but they obtained the contract for the supply of the plant and gas for the generation of electricity for power and lighting purposes at the exhibition. The engines put down were the largest in the country driven by town gas. They were of the "National" type—two being of 1000-horse power each, and one of 750-horse power. There was also the Smoke Abatement Exhibition in Manchester; and gas had part in the National Trades Exhibition at Birmingham, at the Nursing Exhibition, at the Food and Cookery Exhibition, at the Hygienic Exhibition at Dresden, and at other public shows. Among prospective events in this line, we have to look forward to the Smoke Abatement Exhibition in London in March, and to the great gas exhibition in 1913, in connection with the jubilee of the Institution of Gas Engineers.

POSITION OF THE RESIDUALS MARKETS.

The sources of production of residual products continue to increase. But a benevolent order of things appears, as the supply increases, to provide absorbing fields. The dense coke of the coke-ovens can never compete in the same commercial regions as the coke of gas-works; and the production of the latter does not increase *pari passu* with the making of gas, in view of the larger yields of gas per ton. Respecting tar, a better quality is now being produced under the new methods of carbonization; and the distillers recognize this. The application of tar for road purposes is on the increase; and the Roads Board encourage its use, both by advising it, and by making considerable grants specially for the purpose. Specifications have been issued by the Board for tar for road use. These, however, are advisory and not mandatory; and they appear to be as much honoured in the breach as in the observance. Here and there, there have been spasmodic attempts to lay blame upon the use of tar on roads for the poisoning of fish in certain streams. The matter was brought to the attention of the Hants County Council; and a considerable number of road washings were submitted to Mr. W. J. A. Butterfield for analysis. In every case he reported that the samples were free from contamination by tar or tarry matters. The general position of the tar market was described in a paper by Mr. Ernest F. Hooper.

In reference to sulphate of ammonia, as usual Messrs. Bradbury and Hirsch's report, and the report by Mr. W. S. Curphey, the Chief Inspector under the Alkali Works Regulation Acts, contained much information, illustrating how production continued to enlarge from sources other than gas-works, but, on the other hand, how the field of demand continued to expand. In this connection, the Sulphate of Ammonia Committee have extended their operations, though,

as was shown at the annual meeting of the Committee, producers in this country are far behind other countries with the amount of their contributions per ton for propaganda work. The Power Gas Corporation reported that they had put down a large plant in Italy for the recovery of sulphate of ammonia from peat, and that it was entirely successful. In this country, a very serious attempt is being made to establish the growth of beet, and the necessary beet sugar factories. In Germany, beet is responsible for a large consumption of sulphate of ammonia. From agricultural research it is hoped that this commodity will derive benefit; and in this connection it is interesting to learn that the Treasury, through the Board of Agriculture, has sanctioned the allocation of a maximum of £50,000 per annum for agricultural investigation.

When the accounts of gas undertakings come out for the second half of the year, we think it safe to say it will be found that the excellent revenue returns for residuals of the first half of the year will have been fully maintained. We will not quote prices. But it may be said generally that the year opened well for coke. There was a temporary recession of prices in April and May; but in the second half of the year the price fully recovered the best levels, and ended the year very strong. Tar prices did not vary much; but the prices were better at the close of the year than at the opening; and throughout the greater part of the second half, they were at their best. The prices for sulphate of ammonia oscillated a little. There was a gradual ascent in the first quarter. Then a drooping during the second quarter. But during the third quarter, there was an upward move; and in more recent months quotations have been at the best of the year. The prices of nitrate of soda followed much the same movements.

The Coal and Oil Market—Ballot of Miners to be Taken.

Those who made their coal contracts in the early part of the year got in at lower prices than the year before. They were fortunate; for the low prices did not continue long. The tendency was upward, with the result that quotations are now for certain of the Durham brands 2s. 6d. to 3s. per ton more than they were in January. But quotations and contract prices are not always on a par; and if prices continue as they are, contractors will find there will not be such early bookings in the coming year as there were in the current one. The continued unrest among the miners is a cause for anxiety. Negotiations have been held between the Coal Owners' Federation and the Miners' Federation; and the Conciliation Board have also held sittings. But there has not so far been agreement; and last Thursday, the Miners' Federation decided to take a ballot of the men. The results of this are to be sent in by each area to the General Secretary by Jan. 16; and if there are two-thirds majority in favour of a stoppage, notices will be handed in to terminate agreements at the end of February. The main question in dispute is that of a district minimum wage. While the trouble with the railway men has been settled, there is this coal cloud threatening. The Coal Mines Bill has passed; and this provides for greater protection for the miners. No one can complain of this; but it means that costs of inspection and compliance with the Act will have to be reckoned with. If this Act had been passed instead of the Coal Mines (Eight Hours) Act, it would have been a better piece of legislative work, and would not have occasioned so much trouble, expense, and loss as the latter has done. It has, indeed, been one of the greatest disturbing factors the coal industry has ever witnessed. From the latest returns issued, it is gathered that in 1910, the output of coal was about 264½ million tons, or 660,000 tons more than in the preceding twelve months. The value of the output was £108,377,567 or £2,102,667 more than in 1909.

Sir William Ramsay, in the course of his Presidential Address to the British Association, estimated that the available coal supply of this country that could be economically worked would only last 175 years; but his prediction has been seriously challenged. Certainly he did not give sufficient credit to the more economical use that is being made of coal in industry. The oil market has been favourable for contracts; and the promise of prospective additional sources of supply, encourages the belief that prices will not fluctuate much in the upward direction, notwithstanding the increased demand it is hoped will arise for oil for power and other purposes.

Carbonization and Coal and Water Gas Production.

There have been no extraordinary new gas-works schemes to chronicle during the year; but several gas-works have made considerable extensions of plant. Some of the gas proposals that will be discussed by Parliament during the coming session suggest extensive gas constructional work in various localities being on the *tapis* before long. The technical interest of the year on the works has been directed more to new applications and to investigations of methods. The gas industry offers year by year enlarged scope for physical and chemical research.

Of specially noticeable developments this year in carbonizing plant, there have not been any; and the Carbonization Committee of the Institution did not present, at the meeting in Glasgow, a report that included any particularly pronounced feature. Vertical retort-settings are growing in favour—the continuous systems obtaining the preponderance of adoption in this country; the intermittent continuing to be the favoured one on the Continent. It can be said now that one or other of the systems is having application even to the uttermost parts of the earth; for in Australia both the Glover-West and the Dessau systems are being, or have been, applied. As far afield, too, as Japan, there is application. America seems to be disposed to adopt settings of its own devising rather than those that have been developed here or in Germany. But it may be that comparison of results may yet lead our American friends to see in the alien settings advantages that they do not appear to have gained in their own. Coming home, several fresh works, however, will soon be having—if they are not already completed—vertical settings in operation; and it is being proved by experience that the larger works have no claim to any monopoly of either the continuous or intermittent system. A series of communicated articles on the subject of the Dessau system has appeared in our columns during the year; and a valuable set of papers presenting actual experience with that system, the Woodall-Duckham, and the Glover-West were presented at the meeting of the Institution in Glasgow. It was hoped by some people that these papers would have shown such conclusive advantages in favour of one setting over the others that there would have been no further question as to which is the best. But that was a misplaced hope; and the value of the papers was simply that they brought working information up to date, gave the members the essence of accumulated experience, and supplied a new starting-point from which to consider relative merits.

We are satisfied more than ever of this, that it is a good thing there was no investigation by a body such as the Carbonization Committee of the Institution of Gas Engineers that would have given a sort of preferential testimonial to one or other of the systems. It has been proved pretty conclusively that, while the continuous system appears to have gained favour here and the intermittent system on the Continent, local conditions and coke requirements—particularly these—must have some weight in the matter of selection. Mr. Alex. Wilson in the intermittent-continuous system he has developed at Glasgow, and about which we heard more in his Presidential Address to the Institution last June, has had the character of the coal that he uses, and the quality of the coke that he requires, in mind in designing his settings; and Mr. W. R. Herring, in planning his trial setting for Edinburgh, also had in view the ability to change from continuous to intermittent working at will according to the character of the coal being carbonized. It was the character of the local coal supply that weighed heavily in the consideration of Mr. P. C. Holmes Hunt in resolving upon the Dessau system for Melbourne. On the other hand, continuous carbonization has considerable attractions. An extremely interesting account of four years' working with the Dessau system at Cologne came to hand during the year; and in addition to the now well-known qualitative advantages in respect of calorific power and purity of gas and residuals, the wear and tear on the settings during the four years was shown to have been very small indeed. To get a truly comparative basis of comparison for wear and tear, it should always be averaged out at per 1000 cubic feet of production.

But horizontal working is far from being degraded yet. The heavy charges and the longer duration method of carbonization has secured more and more adherents; and the old makes and less economical working of the past are sinking deeper among superseded practices. More was learnt about the system during the year, and those who

practice the new methods are doing so in a less haphazard way than some were previously doing. It has been found by experience that in getting good results there is some relation between the size of charge, the quality of coal, the length of the carbonizing period, and the degree of temperatures. Mr. G. M. Gill described how, in a station possessing two retort-houses, he was able to work twelve-hour charges with two eight-hour shifts. Besides the De Brouwer projector machinery that has done so much to facilitate the practice of heavy charging, the West, the Arrol-Foulis, and the Fiddes-Aldridge machines are all now so constructed that they will deposit heavy charges in the retorts as required. Standing out, with splendid isolation, Dr. W. B. Davidson gave during the year a further account of his experimental work at Birmingham, which assured him that, if retorts and coal were properly handled, they could be made to produce with light charges and short-hour working results equal to those realized with heavy charges. Yet his experience is opposed to the theoretical and chemical considerations expounded by Professor Lewes, in his recent Cantor Lectures, and by Drs. Colman and Lessing.

Large chamber working has not secured a footing in this country; but more information has been published in the course of the year, and experience in Germany shows that time has improved both working and results.

There are no striking inventions to record this year in gas-works plant, but there have been a large crop of improvements in detail to secure better results. What with the large number of Gas Associations now existing, and particularly through our much-alive junior organizations, there is scarcely a part of gas-works plant or method that has not undergone discussion in some form during the past twelve months. The work is too voluminous for review—it extends from refractory materials (to which subject Dr. Rudolf Lessing contributed before the Liverpool Engineering Society) to gasholders. The Refractory Materials Committee presented a further valuable report as a result of the charge committed to them, together with a specification for fire-bricks and other parts. Settings and their equipment have been dealt with in papers and articles. On the point of equipment, the single ascension-pipe has been accused of being a contributory cause of the increased production of carbon disulphide. Mechanical transport, too, has been prominent; and from the midst of the writings and discussions and intelligence as to extensions, prominent comes out the electric telpher as an economical means of moving material, especially hot coke. But modifications are being made in the telpherage system of quenching, as in some works—probably due to the method of carbonization, the character of the coal, and, consequently, the physical characteristics of the coke—it is found that the coke is much depreciated by sudden total immersion through lowering the skip into the tank of water—fracturing taking place, and an undue quantity of moisture finding harbourage in the coke. Experience in other places does not give confirmation to this; but there are no doubt easily discoverable explanations.

Water-gas manufacture has been coming more and more to the surface during the year. Various reasons could be assigned for this. One is the fairly low levels at which oil prices have been ruling; another the prospective large increase of oil production and the law of competition coming in to keep prices at tempting figures. Another is the relief that the plant affords in preventing large coke accumulations when the markets for solid fuel are not at their best. But the year has emphasized another advantage; and it is that during periods of severe labour unrest such as we have been experiencing, the water-gas plant is an estimable auxiliary. When stocks are being dipped into abnormally through interruption in the regular delivery of coal, the water-gas plant befriends the gas manager, and eases anxiety. The point has also been suggested that the water-gas plant avoids the necessity for making increased provision for the accommodation of coal stocks. These are of the lessons of the year. Now that illuminating power has lost its high estate, a lower quality of water gas is required; and this means cheaper production than formerly. All these favourable considerations are in addition to the convenience of availability in case of emergencies—such as some sudden heavy demand.

Calorific Power.

Bearing on the question of carbonization, a large amount of progressive technical freedom would be given to the gas industry if Parliament would release it from the trammels of the illuminating power standard, and give to it a reasonable gross calorific power one. This was a point in Professor Lewes's Cantor Lectures at the Society of Arts, treating of the carbonization of coal, and in one of Mr. E. W. Smith's lectures at the Manchester University, dealing with high-pressure gas distribution and application. The Photometrical Commission, meeting at Zurich (on which occasion Dr. Harold G. Colman and Mr. W. J. A. Butterfield were the delegates for the Institution of Gas Engineers, in place of Mr. Charles Carpenter and Mr. James W. Helps), passed a unanimous resolution recording the view of the delegates that the test of the illuminating power of luminous flames had lost all importance under modern conditions, and that for the evaluation of gas to-day the test for calorific power should be substituted for that of illuminating power. At present France appears to be in favour of calorific values being stated in net terms; while all other countries (like the Metropolitan Gas Referees) are in favour of the gross value. Paris has now adopted a calorific standard equivalent to 522 B.Th.U. net. In an article on April 25 (p. 214), we showed what was being done in America and elsewhere, and urged that calorific standards should not be set at a point that would not conduce to economy. The Canadian Gas Association are also using their efforts to secure a calorific standard. The question was likewise raised at the meeting of the Société Technique; and several leaders of the French gas industry expressed themselves as favourable to the adoption of a standard. Wherever the matter is discussed, it is agreed that the illuminating standard must go, and that there must be no dual standard of quality to harass gas makers, and to produce uneconomy in production.

Coke-Oven Gas for Town Supply.

Significant evidence has been published during the year as to the progress that has been made in the utilization of coke-oven gas for town supply in America and Germany. In both countries towns are now supplied at considerable distances from the coke-oven plants; and, under the ruling long-period contracts, the ordinary gas-manufacturing works have been closed down. In the United States, the last returns show that the total sales of coke-oven gas for town supply amounted to 12,000 million cubic feet in the year; and this from eleven plants. Full particulars are to be obtained from the volumes of the "Journal" for the year. One of the latest schemes is for the supply of Ostend; and the Municipality have recently entered into a contract for this to be done. Opponents of this comparatively modern development in the utilization of a secondary product of the coke-ovens, contend that, when the cost of transmission over long distances is added to the price charged for the gas, for town supply, it is not so economical as local production; and a further disadvantage is that the community have to pay dearer for imported coke for domestic purposes. In this country, there has not been any startling development in the direction of utilizing coke-oven gas for town service. The Little Hulton scheme of supply from the Earl of Ellesmere's coke-ovens has now been consummated; and several villages in the near neighbourhood of coke-oven plants are being supplied. But nothing more imposing has been done. Papers on the subject by Mr. Ernest Bury and others have been published; and it is manifest that the managers of coke-oven plants are doing their best to create a market for the waste gas.

Condensation.

This long-neglected subject is again being technically investigated. High temperature carbonization has quite altered the temperature conditions obtaining between the hydraulic and the condensers; and there are students of the subject who consider that the process of condensation requires to be reorganized. M. Laurain and others suggest a sudden cooling of the gas directly it leaves the retort-bench, with the view of minimizing the percentage of naphthalene in the gas. The argument is that the natural absorbent of naphthalene is the vesicular tar in suspension at the outlet of the hydraulic main; and that this acts most effectively when cold. Therefore, the condensation process should be arranged so that no particle of the solvent escapes from the gas before being put into equilibrium with it at the lowest temperature. M. Grebel, however, has questioned whether this process would not result in the loss of illuminating power. Mr. H. L. Doherty has produced on new lines a washer-cooler for water gas. The subject of quick *v.* slow condensation has been a topic of discussion.

Purification.

A great amount of attention has been bestowed upon purification processes. Several gas-works have partially retraced their steps to lime purification pending the production of a system of ridding the gas of excess grains of sulphur compounds that shall be free of the nuisance accompanying lime purification as ordinarily practised. Coventry is among the places that has boldly gone back to the old system of lime purification. But Cheltenham has revived coal-liming, on systematic lines—the lime being powdered and applied in regulated quantities. Messrs. R. O. Paterson and L. E. Twycross are the inventors of the system of application; and special articles in our columns, as also a paper by Mr. James Paterson before the Southern Association, have proved its success at Cheltenham for the main purpose, with a number of unexpected concomitant advantages. In America a system has been developed for reheating purified gas to the temperature at which the sulphur compounds are broken down into easily removable sulphuretted hydrogen. Mr. E. V. Evans, of the South Metropolitan Company, has also devised a system for the partial conversion of the carbon disulphide to sulphuretted hydrogen by subjecting the former to heat. He finds the important thing to attain success is the preheating of the gas before it passes over or through the contact substance, as the high temperatures otherwise requisite have produced failure in work on these lines. Mr. G. M. Gill has described in the course of the year some experimental work on the washing of gas while hot. The Burkheiser process for the purification of gas and the simultaneous production of sulphate of ammonia has been prominent during the year. Feld's centrifugal washer-scrubber has undergone improvement.

There have been fatal explosions and fires in connection with washer-scrubbers at Stalybridge and Sheffield. In the case of Stalybridge, Professor Harold B. Dixon and Mr. S. Meunier came to the conclusion that the heavy accumulation of rust on the iron plates must have been acted upon by the foul gas, firing a layer of iron sulphide sufficiently sensitive to oxidation to heat up when air was admitted while cleaning was in progress. The heat produced probably volatilized some of the constituents of the tar, resulting in the formation of an explosive mixture before the fire could be smothered. Confirmatory evidence in connection with similar experiences came from Mr. J. van Rossum du Chattel and Mr. H King-Hillier. The experience gained at Sheffield led Mr. J. W. Morrison to much the same conclusion. Accidents with ordinary purifier-boxes, and their prevention, were the subject of correspondence initiated by Mr. H. Townsend.

Gasholder Accidents.

Gasholder construction has been the subject of technical communications during the year; but notable about gasholders is the further serious failure of a large one on the Continent. This was a new holder at the Vienna Corporation Gas-Works; and it was the largest on the Continent—having a capacity of 8,830,000 cubic feet. The collapse occurred while it was being tested with air. The report on the Hamburg gasholder disaster also appeared early in the year; and there is little doubt that the experts' conclusion is that the elevated tank construction had nothing to do with the catastrophe, but that it was attributable to weakness in the design. A small single-lift gasholder at Lancaster, after nearly half-a-century's service, also collapsed.

Distribution.

In connection with the transmission of gas in districts of supply, high-pressure distribution has received considerable attention, apart from the schemes that are laid specially for the purpose of doing local business in lighting and industrial heating. As a factor in economically supplying distant places and in boosting supplies, high-pressure distribution has taken a permanent place. Conspicuous among the descriptive work of the year have been the papers read by Mr. F. C. Willis, relating to the work done at Tynemouth, and one by Geh-Baurat E. Blum on the work that has been done in Germany in the same direction. High-pressure gas distribution has pointed the way to the expansion of the areas of many gas undertakings. With the growth generally of higher district pressures, the necessity of service governors is becoming more marked; and the time may arrive when they will be considered as imperative. The discussion of the subject by Mr. W. Carmichael Peebles and Mr. J. G. Clark, in papers read by them during the year, allots to volumetric governors and constant pressure governors their proper spheres—the former are useful for individual appliances and maximum consumption; the latter for the varying requirements of consumers. The miscellaneous distribution topics of the year included a report presented by Mr. James W. Helps to the Institution of Gas Engineers on the subject of the unification of pipe threads.

Residuals Production.

Technically, there is not much to say on the subject of the secondary products. It is being more generally recognized that the newer systems of carbonization produce coke of enhanced value; that tar is yielded that has greater freedom from free carbon and naphthalene than with high temperature carbonization and light charges; and that the production of sulphate of ammonia per ton of coal carbonized is greater. In all these directions, there is commercial value. With horizontal working, the South Suburban Company have produced 27·3 lbs. of sulphate per ton of coal, which compares well with 28 to 30 lbs. variously claimed by vertical retort users. Greater attention is being paid to sulphate plants for small works; and several have entered upon the manufacture. A question that was the subject of controversy in 1883-4 was revived by Mr. F. D. Marshall in a lecture delivered at the Manchester University. He pointed out that large quantities of ammonia were lost in the process of gas manufacture. While we only get about 1 ton of sulphate of ammonia per 100 tons of coal, there are something like 4 tons lost; and he believes this loss exists in the coke and breeze. He pleaded for attempts being made to recover this waste of a valuable product. Mr. A. V. Hendrickson gave in our columns the results of experiments he has made on the loss of ammonia from its solution. A valuable series of papers on the subject of the bacterial purification of ammonia recovery liquor was read before the Manchester Section of the Society of Chemical Industry.

Control of Manufacture and Production.

The value of greater scientific control of the methods of operation on gas-works has received additional contribution during the year. The fact is being impressed by circumstances and deeper inquiry. The work of the Refractory Materials Committee, such lectures as the one delivered by Mr. John T. Sheard, at the Manchester University on the "Chemical Control of Gas-Works," and the increasing recognition that economy results from scientific regulation, and that uniform production is an essential condition with the diverse uses of gas especially for heating purposes, are all impressing the fact of a totally different order of things upon the responsible engineers and managers of gas-works. Pyrometry has received larger consideration in technical proceedings; and the visual test and the means of testing temperatures approximately are bending before the more exact appliances and systematic methods of obtaining accurate records. So throughout every manufacturing department—chemical and other methods of control are being more widely applied. It is clear this will have to extend among the gas undertakings of the country. In regard to the primary product itself, means have been devised to lighten the work of maintaining oversight of production—its constitution, thermal value, specific gravity, and so forth—by means of automatic and continuously recording instruments. This was seen in articles published last week. The discussion of calorimetry and of calorimeters has been an especial feature of the year. Photometry, too, has received a good amount of attention. Though the standard of quality for gas may pass from the stage of statutory requirement, and be superseded by calorific power, the testing of the illuminating power of sources of light, and the testing of the illumination afforded, will always be requisite. Conspicuous among the interesting publication of work in this connection during the year has been the report of the proceedings at the meeting of the Photometrical Commission at Zürich. Through the work of this Commission, England, France, and America have been brought into line in favour of the candle as the standard unit; but Germany and Austria are still holding back. Valuable contributions have been made to these various subjects.

Illumination—High-Pressure Gas Supply for Lighting and Industrial Purposes.

The year has seen considerable impetus given to the study of the science and art of illumination, not only for interior purposes, but exterior, largely through the efforts of the Illuminating Engineering Society and through individual

interest. There are signs that our public departments and authorities concerned in our public institutions and industries are tending to the view that there should be a rational application of both natural and artificial illumination according to the purpose for which lighting is required—such as in schools, libraries, factories, and so forth. Endeavour has been directed to securing the interest of those who can in any way influence the movement—such as architects, physiologists, and medical men. The protection of the eyes against glare—against lights of such high intrinsic brilliancy as metallic filament lamps—and the provision of a minimum illumination are lines of necessary work. The gas industry will, with the electricity industry, have generally to take account of this movement. Lectures in both gas and electrical illumination have been established at the Regent Street and Battersea Polytechnics and at the Northampton Institute this winter session; and we understand several students connected with the London Gas Companies are attending them. It is a good sign; and from these small beginnings, the movement will spread.

But despite rules and prescriptions, shopkeepers will insist on an almost barbaric display of illumination in front of their shops for advertising purposes, and street-lighting authorities will—and this is a growing requirement—insist on their main thoroughfares being illuminated by high-power units of light. In both these directions of business, high-pressure gas-lamps of the inverted types and flame arc lamps have been wrestling vigorously for supremacy. Where there is fair commercial competition, the high-pressure gas-lamp can beat the electric flame arc in the matter of price, efficiency, steadiness, and reliability. Tradesmen have recognized this. In the course of the year a large amount of information has been published in our columns, which shows, in point of cost, how the high-pressure gas-lamp has placed a powerful weapon in the hands of the gas industry, and how really effectual it has been, through parade (or scale) lighting, in securing large stretches of shop lighting, and disestablishing electric lamps for this purpose. The managers of electric undertakings have received a genuine fright through this form of competition, in which they had imagined flame arc lamps reigned supreme. A paper was read on the subject before the Incorporated Municipal Electrical Association by Mr. A. H. Seabrook, the Chief Engineer of the Marylebone Electricity Department; and there was ample evidence forthcoming in the discussion that the electricians felt this competition most acutely. The subject has been one for the consideration of many municipal electric supply committees; and several have adopted inclusive costs per annum for outside shop lighting in the attempt to stop the further change-over to gas lighting. But they cannot, except at a sacrifice of profit, get down to level prices with high-pressure gas lighting. This is seen by the comparative costs that have recently been published in our columns in connection with the controversy with the "Engineering Correspondent" of the "Daily Telegraph." Retaliation shows itself in more than one way. One petty form has been, where electric motors are adopted for driving isolated compressing plants, to charge the energy required at as high a price per unit as possible, instead of at the power rates.

There is an interesting feature about this shop lighting. The old order of compressing plants for individual installations is only being continued now for quite special cases where there is not much high-pressure gas business to be done. A long time since, we were saying in these columns that the day would come when practically every town in the country would have its high-pressure main in the principal streets and shopping centres, if only to enable the local gas undertaking to advertise its lighting capacity in the matter of high-power units. The year has seen a surprising spread of the installation of high-pressure systems in towns large and small. In London and the suburbs, perfect networks of high-pressure mains may now be found, and in the Provinces, in the main streets of many places, systems have been instituted, where economically possible, served from one central compressing station. This dual supply of high and low pressure gas will take an important place in the history of the gas industry in the second decade of the present century. The usefulness of such services extends not only to shop lighting, but to street lighting and to industrial purposes.

Taking industrial applications first, there has been seen during the year, through special articles in our columns, through the Institution paper of Mr. E. W. Smith, and through his lectures at the Manchester University, the success of high-pressure gas in industrial heating operations in Birmingham; and growing intelligence on the subject is stimulating interest in the industries. The speeding-up of factories through its means, the power of temperature regulation, the savings that all contribute to works' economies, are attributes that speak loudly in its favour. High-pressure gas supply for this purpose is new; but low-pressure gas supply and high-pressure air supply has also secured an extensive application in industry. Gaseous heating, the primary fuel being drawn from the town mains, has now established itself. The authorities at the Royal Mint have pronounced in its favour, after trying the best that coal, coke, oil, and electricity could offer; and workers in the fine metals generally have, by adoption, shown their appreciation. A useful paper on the application of gas to industrial heating, by Herr F. Messenger, the Gas Inspector of Charlottenburg, was also published during the year.

Street Lighting.

Turning to street lighting, the Westminster installation of high-pressure lamps, and that at the Festival of Empire Exhibition at the Crystal Palace, were great attractions during the year to lighting authorities. Regarding the Westminster lighting, during the first three months of the year, Mr. J. W. Bradley made numerous tests of the high-pressure lamps (also of the low-pressure inverted ones), and showed that the Gaslight and Coke Company were giving illumination in excess of their contract power. Since then we have published in our "Electric Supply Memoranda" the relative costs per annum per candle power of the lighting in Westminster. Through municipal ownership of electricity supplies, there is a difficulty in getting the adoption of high-pressure gas-lamps for street lighting; but where competition is allowed, high-pressure lighting on the points of cost and merit ought to succeed. Manchester has done some good work in demonstrating this.

Just before the close of the year, revelations were made concerning the conversion of the Hampstead street lighting from gas to electricity. Early in 1910, the Gaslight and Coke Company made a vigorous attack on a proposal of the municipal authorities to change from gas to electric lighting for street purposes. But the Council were led in the matter by their electrical officials, and refused the offer of the more economical and efficient process—economical in initial and working expenses—of improving the street lighting by inverted gas-burners, and went their own way. Nemesis has overtaken them. They have just learned that they were deceived as to the real cost of conversion. Instead of the estimated outlay of about £15,000, the actual cost has worked out to rather more than £25,000; and it has been discovered that many items that ought to have been charged to this work have been distributed among other items in the Electric Department's accounts. The disclosure has been an unhappy one for the borough—and for the officials concerned. The Chief Electrical Engineer has been asked to resign, and his assistant has been promptly dismissed from the service of the Council.

The year has been marked by some novel happenings in London in connection with the street lighting contracts of the City Corporation and the Borough Councils. The Gas Companies continued to walk off with the contracts where there was not municipal ownership of the electricity undertakings; but in Holborn and the City, the Gaslight and Coke Company were severely challenged by the Electrical Companies, who felt their prestige was assailed by repeated defeats. The result in Holborn was that price-competition created a *cul de sac;* and both parties felt that it was no use carrying the matter further. It is a long story; and we will content ourselves with the statement that the upshot was a combined tender, which was accepted, from the Gaslight and Coke Company and the Metropolitan Electric Supply Company. Similarly, after some six years of experimental lighting competition, the Gaslight Company and the City of London Electric Supply Company considered it expedient to come to a mutual arrangement with the City Corporation for improving the lighting of the City, whereby much more illumination, at a much lower cost than before, will be obtained. One feature of this scheme is to be the almost complete abandonment of lamp standards; and the adoption of central suspension for flame arcs and high-pressure gas-lamps, as well as a reversion to bracket lighting in the side streets. As in other London contracts, so in this City one, the inverted gas-burner for both high and low pressure work is sweeping the vertical incandescent gas-burner from the

streets. But we do not hear so much as we should like to about the improvement of street lighting from the Provinces by the larger and the systematic adoption of modern lamps. There is much good work being done—there must be, judging from the amount of business reported to be in the hands of the lamp makers; but it is of a spasmodic rather than of an extensive and universal order. We have not yet had the result of the labours of the Joint Street Specification Committee of the Institution of Electrical Engineers, the Institution of Gas Engineers, and the Illuminating Engineering Society; and it is fancied—the contrary views of experts suggest it—that they have a difficult task before them. The reports that came to hand during the year of the success of automatic lighting were of a character that leads us to anticipate an increased adoption of this means of lighting and extinguishing—the year's published experience especially applying to Liverpool and Newcastle.

Looking abroad, we learn that Berlin is spending about 1 million marks a year in extending high-pressure gas lighting, and that Paris is considering a scheme which will run into an expenditure of about 15 million francs for lamps, brackets, and services, but exclusive of mains and compressing stations. Paris is convinced that high-pressure gas lighting is cheaper and more reliable than electric lighting. An experiment that was made in that city with lighting by means of low-pressure gas and high-pressure air proved unsuccessful, owing to the moisture contained in the air condensing in the pipes.

While so much success has been achieved in lighting for practical purposes, it has to be confessed that for decorative purposes for outside illuminations during the Coronation festivities in London, electric incandescent lamps were in favour. Still gas lighting had some excellent displays both in London and in the Provinces, as our pages testified. It was pointed out by our electrical friends that gas showed up badly in the gales that were blowing during the lighting hours on one evening of the festivities, to which we were able to reply by pointing to complete collapses of certain installations of Coronation illumination through one of the many mishaps to which electric lighting is subject.

Low-Pressure Lighting, Heating, and Power.

In the field of improvement, there is nothing special to chronicle in the mantle line. But the position of thorium is being established stronger than ever. It will be remembered that the supply of thorium was at one time in the hands of a powerful Continental syndicate. But their power has been broken; and the attempt to further regulate prices has failed. The Brazilian Government have expressed their determination not to let another monopoly get sole control of the supply of monazite sand; and, moreover, information was received that the Imperial Institute has been testing samples of monazite sand from India which is richer in thoria than the Brazilian or Carolina sands.

A general reference to high-pressure lighting has already been made. In connection with low-pressure inverted gas-burners, the feature of the year has been the appearance on the market of lamps which will give at district pressures an efficiency of 40 candles and upwards per cubic foot of gas consumed. The range of good ordinary inverted burners, fittings, and glassware continues to extend; and it cannot be claimed by competitors that for artistic effect the decorative dressings of inverted gas lighting are not the equal of those of electric lighting. Generally speaking, all round, the trend of events has been to give the consumers, through the appliances used, increased value for the money expended on gas. This increased value means much more than the reductions made in the price of gas. But in connection with lighting, as with other forms of domestic applications, there is an important matter that has been provisionally discussed during the year, and that is the absolute necessity for better educating gas-fitters and other workers in the distribution department, so as to keep them quite abreast of the times in the technic of their work. A good deal is being done in this direction; but much more is necessary. Many educational lectures have been delivered to the employees of gas undertakings during the year by the specialists in the service of the makers of gas appliances, and by gas engineers. This is good; but it requires to be supplemented by more continuous work. And the Manchester District Gas Institution and the Commercial Sections of the other District Associations have been attempting to do something in this direction, and to extend the work to outside fitters. There is urgent need for pressing forward with this work.

The lines of the larger development of the gas industry are, without question, to be found in the application of gas for heating—domestic and industrial. The modern gas-fire is extending in popularity by leaps and bounds; and the gas-fire has been the subject of several papers before the technical organizations during the year. The Smoke Abatement movement is assisting in the work of extending the use of gaseous fuel; and the cry for a more sanitary atmosphere in our cities and towns is spreading. It is to the interest of the gas industry to encourage the cry, and to supply the answer. The efficiency of well-constructed fires is now of a character that alone commends them; but warning has been given that a great deal of harm can be done to this promising field of business by the patronage by gas undertakings and consumers of ill-designed and low-efficiency fires. The fires that were introduced for the present season show that the radiation efficiency in the best types is on a high scale—between 50 and 60 per cent. is reported; and that the waste heat for chimney draught has been reduced to something like 20 to 25 per cent.—the remainder representing convected heat. But the feature of many fires this year has been the enhancement of artistic design, in order to meet the requirements of the ornate character of modern furnishing. Bearing upon the efficiency development of the gas-fire, the Gas-Heating Research Committee of the Institution of Gas Engineers presented their final report; but it is hoped that the Livesey Advisory Committee will arrange for the continuation of the research at Leeds University. Gas heating is too big with importance for the gas industry for any cessation of effort towards raising and maintaining the efficiency of production by persistent investigation.

Retailers of household coals are not looking with favour upon the increasing use of gaseous fuel; and at least one firm have in their advertising literature already adopted the tactics of the electrical industry in throwing mud. The forces of the growing economy, the cleanliness, and the convenience of the gas-fire are too strong for this sort of thing. But regarding economy, the price of gas plays an important part; and several concerns are encouraging the adoption of the gas-fire by the application of discount meters. Accounts of such experience have been published during the year. There has been a little abatement of the opposition of the factory inspectors and others to the use of flueless radiators in large and spacious places; it having been shown—by Dr. Toogood, of the Lewisham Infirmary, and others—that, with the simplest of ventilation (such as is requisite anywhere for apartments occupied by human beings), these radiators, properly constructed, are quite harmless. Heating by hot-water radiators supplied by gas-boilers is also growing. The provision of hot-water in the household by means of gas has been receiving a large amount of attention. This is a field of enterprise that is ripe for cultivating; for there is no competitor here that can rival the convenience and efficiency that gas can offer.

In regard to cookers, there is not much to report, excepting that they are continuing everywhere to increase the day load. The electrical industry however is attacking this field; but more on the matter when we next week review in "Electric Supply Memoranda" the principal events of the year in association with the electrical industry.

Gas-furnaces for industrial use, as we have already said, are numerically extending at a satisfactory rate. The authorities at the Mint have adopted them; and the gas authorities of Birmingham, Sheffield, and other places are doing handsome service for themselves and the gas industry generally in this direction. The days of the coal or coke fired furnace are passing.

Pre-eminent in interest from the technical point of view has been the evidence afforded this year of the practical applications of surface combustion in securing high radiation temperatures in industrial service. In the lectures that Professor W. A. Bone delivered before the Royal Institution and the Institution of Gas Engineers, he demonstrated the high heating efficiency that can be secured in steam-boilers and in industrial and other operations by this method, on which he has been working, in conjunction with Mr. C. D. M'Court and Mr. J. W. Wilson. The members of the Society of British Gas Industries also saw this on the occasion of their visit to Leeds early in the year; and interest in America was aroused by the lecture Dr. Bone delivered before the American Gas Institute at their recent meeting. There are hopes of great things issuing from this new

method of applying gaseous fuel; and the demonstrations of the year have encouraged these hopes.

In the power field, a peculiar condition of affairs exists; and there is evidence that the steam-engine is the greatest sufferer from changing conditions. There is no question the electric motor has obtained a large application; and the year has seen a big boom in the adoption of the Diesel oil-engine—particularly for electric lighting stations. Suction or pressure gas plant, on the other hand, is not looked upon with such favourable eyes as it was at one time, when manufacturers were enamoured of the seductive fuel costs presented to them. These costs were not the sum of expense entailed; and the trouble that has been found to arise from these types of plant represents indirect costs that are best realized by experience. Just one illustration of the effect of experience upon manufacturers. Mr. R. J. Rogers was telling the Midland Junior Gas Association in October last that, in the Birmingham district, manufacturers now prefer town gas at 1s. 6d. per 1000 cubic feet, less a discount of 5 per cent. In 1906, so far as could be ascertained, the number of suction-gas plants in the district of supply was 150; while to-day the number of plants is only 60. The gas industry are in a better position than ever to give lower prices for power purposes; and the indications that gas-engine makers supplied a few years ago, of giving the gas industry the cold shoulder in favour of prosecuting business with suction and other producer gas plants, are being reversed. With cheaper fuel supply, the limits of economical use of engines on town gas are being pushed higher. For engines of the higher powers, blast-furnace gases and producer gases hold the monopoly. But at the Festival of Empire Exhibition, "National" engines of 1000 and 750 horse power were at work on the South Suburban Gas Company's gas, generating electricity in an economical manner. Therefore, notwithstanding the prosperity of some of the competitors of the gas-engine, it was learned at the beginning of the year that the demands on the gas-engine makers were such that more horse power than ever was being represented by their sales; and in certain instances so much so that the erecting-shops were being extended. Improvements are still being effected in engines. One of the most interesting of recent changes in engine operation has been the adoption of governing by varying either the quality or the quantity of the gaseous mixture, in place of the hit-and-miss system of governing. Testimony asserts that gas-engines on town gas stand in a more favourable position than electric motors in regard to breakdowns; and evidence has likewise accumulated that, on the horse power basis of calculating cost, the gas-engine is the more economical. At the Birmingham University in connection with the Midland Junior Gas Association, Professor F. W. Burstall has been delivering some particularly interesting lectures on the subject of the gas-engine.

Technical Associations.

Passing to the work of the technical organizations associated with the gas industry, the year has illustrated more than ever the fact that there is no dearth of material for their discussion, and work for them to do. Subject and work expand; and this is as is expected in an industry the technical and commercial aspects of which are, through progress, ever changing. In this review, mention has been made of various subjects that have received consideration at meetings; and here space forbids a complete cataloguing of them. The Institution of Gas Engineers held a highly successful meeting in June in Glasgow, under the presidency of Mr. Alexander Wilson; and the magnificent reception by the Lord Provost, the Corporation, and the Gas Committee is indelibly marked upon the tablets of the memory of all who were participators in the city's bountiful hospitality. So far as the technical proceedings there were concerned, the papers were of a high order. But the time devoted to them was overcrowded; and this is a matter that will have to be legislated for before another meeting. There has been discussion by the Committee to whom was referred the task of considering the broadening of the basis of the Institution, on lines suggested by Mr. James W. Helps when President; but it is considered that the matter can now be deferred—anyway for a time—to ascertain how the British Commercial Gas Association shapes, and how far it meets a widely acknowledged requirement. The Institution on the one hand, and the British Commercial Gas Association (whose work is referred to elsewhere) on the other, are not the same thing, however, as one solid central organization for the gas industry. Since his accession to the presidency, Mr. R. G. Shadbolt has had a busy time in several ways. The claims on the President, indeed, become weightier every year. The jubilee year of the Institution will be in 1913; and Mr. Corbet Woodall has acceded to the desire that he should occupy the presidential chair that year. Among the plans for celebrating the jubilee, is a proposition for a large-scale gas exhibition.

The District Gas Associations, their Commercial Sections, and the Junior organizations have all a good year's record to their credit. A special feature of the North British Association meeting in the autumn was the inauguration of the William Young Memorial Lectures, by the presentation of a masterly "Appreciation" of the work of William Young from the pen of Dr. Alfred Daniells. The technical proceedings of the Junior organizations show that the coming responsible executive officers of the industry are stamped with the hall mark of efficiency. Their addresses and papers have been good in subject-matter; but some might have invited a larger circle of readers if they had only been moulded in a more condensed form. A Junior Gas Association has been formed in Canada, which is a compliment to the Junior organizations of this country. The Commercial Sections of the District Associations held a joint sitting at Glasgow during the Institution meeting, and discussed the question of the education and certification of gas-fitters, and urged further support to the propaganda work of the Sulphate of Ammonia Committee. The Society of British Gas Industries (under the presidency of Professor Arthur Smithells, and the chairmanship of Mr. H. James Yates) have had an excellent year; and appropriately, with the presidential link with the Leeds University, they have devoted a good deal of attention to the subject of science and co-operation in industry. In very practical forms, they have evinced their belief in both—in co-operation, by uniting in the publicity scheme, by the voting of 10 guineas a year in prizes on the results of the City and Guilds of London examinations in gas supply (Honours grade), and by conference with the Institution of Gas Engineers. Under the presidency of Mr. H. E. Jones, the Gas Companies' Protection Association has continued to keep a watchful eye over the parliamentary interests of gas companies; and, through the Association, the subscribers continue to obtain much valuable information. We have already alluded to the work of the Sulphate of Ammonia Committee and that of the Society of Illuminating Engineers.

The German and French Gas Associations had profitable sessions; and the other Continental Societies have also shown much vigour. The Société Technique have entered upon new and useful operations in delegating to commissions the work of keeping track of, and reporting upon, progress in different departments of the industry's technic. Last year the gas companies of France contributed to the Society £1146 for the prosecution of technical work; the special purposes fund of our own Institution was financed to the amount of £356 18s. 6d.! The proposal, however, to devote up to 10 per cent. of the publicity fund to technical purposes will put our own Institution on a much stronger footing. In America, Canada, and Australia a large amount of work has been done by the Gas Associations. Japan, for a great number of years past, has been well abreast of all modern technical practices; and the engineers of the country have now founded a technical organization of their own.

Educational Work.

Up to the present time, the resources of the Gas Engineering and Fuel Department of the Leeds University have not been taken advantage of by students to the extent that had been hoped for; but Professor Smithells (and it may be taken that he also voices the views of Professor Bone) is not at all inclined to be disheartened, inasmuch as his experience assures him that work of this character takes time to establish itself. He gave expression to this view at the recent meeting of the Society of British Gas Industries. At Leeds and Manchester, courses of lectures to gas students have continued at that high standard with which they began. At the Birmingham University, lectures have also commenced. As previously stated, too, at certain educational centres in London, lectures are being delivered on the science and art of illumination. Peripatetic lecturers—specialists from the makers of gas appliances—have generously devoted time to delivering lectures to employees of gas undertakings. Many gas undertakings have arranged means for giving their own employees instruction. The Welsh Associa-

tion have made partial provision for educational work, but not to the extent they would like to. The Manchester Institution have not yet met with the complete encouragement they had hoped for in trying to enter into co-operative work with the master gas-fitters in organizing courses of instruction in modern appliances and fitting for their men. The examinations in gas manufacture and supply of the City and Guilds of London Institute drew on the last occasion an imposing number of candidates; but the candidates should heed the criticisms of the examiners on the character of their work. A voluminous discussion took place at the Institution of Civil Engineers on the subject of the training of engineers. The views, however, were of such a diverse character that the principal outcome of the conference was to show the difficulty of laying down any cast-iron rules that would meet the requirements of the different lines of engineering work, or different grades, or characteristics, of talent.

Gas Legislative Work.

The parliamentary session was a somewhat dull one—that is to say, from the point of view of Committee room work. There was little of it, owing to agreement, and the absence of large schemes or important proposals; and what there was did not occupy much time. Some of the matters that used to be subjects of sharp controversy have settled down to the level of commonly approved matters of the times. There is the No. 2 burner Bill, for example. It is now granted as a matter of course, and unconditionally. In no instance were terms imposed in relation to it during the past session. By the simple process of applying to the Board of Trade under the "other approved burner" proviso in their statutory testing clause, the Newcastle-upon-Tyne Gas Company had the "Metropolitan" No. 2 set up as their standard burner. The Preston Gas Company obtained it, a reduction of 4 candles in their standard of illuminating power, and authorization to redeem £100,000 of unproductive capital. In connection with these various matters, it was considered that their, as yet unused, standard price might be brought down to 3s. 4d. They have hitherto paid only their standard dividend; so that the reduction is practically only a nominal one. In all cases where the No. 2 burner was asked for, it was granted. Even the Liverpool Corporation (the leaders in the fight against the Joint Gas-Burner Bill of 1910) applied for it, and obtained it, for their Fazakerley supply. Speaking of this great opposition, it ran the opponents into £5308 costs, without any other result than a bad beating all along the line. Another Joint Burner Bill is on the board for the coming session; and the fatuous opposition of 1910 is not likely to be repeated. The Canadian Government authorities have simply taken a short cut in the establishing of the burner as that authorized for use in Canada, by prescribing it for all gas undertakings in supersession of the present ones. Parliament authorized the amalgamation of the Barking and the Chigwell, Loughton, and Woodford Gas Companies with the Gaslight and Coke Company. The Swansea Gas Company had a sharp encounter with the Corporation over parts of their Bill. The Margam District Council were granted powers to set up gas-works in their area, and to purchase the part of the Aberavon Corporation property situated therein—the rights of supply of the latter to cease in the district. The Cudworth District Council were also empowered to set up works of their own, and to discontinue purchasing in bulk from the Barnsley Gas Company. The question of purchase was discussed in connection with measures promoted by the Ashbourne, Cannock, and Sidmouth Companies; and we shall see the developments of these discussions next session. The St. Helens Corporation obtained the right to compel the use of silencers on gas-engine exhausts.

The subject of stand-by clauses was prominent—the Local Government Board and the Home Office occasionally raising objection; but in all cases Parliament permitted the clauses. With the Swansea stand-by clause. it was modified so as to ensure that it does not affect domestic consumers who use electricity. There were several fights with County Councils over additional control that they require in respect of the use of roads by gas companies. They desired to impose greater depths for pipes, limitations as to the use of roads, and to put upon the shoulders of the gas companies concerned any and every expense possible. Where there was no agreement made, the gas companies were always victorious. The Tamworth, Enfield, and Uxbridge Companies offered the most strenuous resistance. In the case of one company, the Gas Companies' Protection Association rendered financial aid (it was learned from the President, Mr. H. E. Jones) in contesting, through the Board of Trade and in both Houses of Parliament, a proposal to make the company liable for damage done by the use of a steam-roller of 15 tons weight (at one time 20 tons was mentioned). This would have been a very bad precedent. Mr. W. R. Herring and Mr. Arthur Valon contributed special articles to our columns bearing on these matters. An important decision was given by the Unopposed Bills Committee when they decided to impose maximum borrowing powers on the Milford Haven District Council in respect of their gas undertaking, so as to ensure them coming to Parliament periodically for the revision of their powers. Various gas companies secured authorization to supply electricity, or to apply to the Board of Trade for Electricity Provisional Orders.

The coming session holds out the promise of much interest, though the number of promotions is not great. The South Suburban Company are proposing to absorb the Bromley and the West Kent Companies; and the Wandsworth and Putney, the Mitcham and Wimbledon, and the Epsom and Ewell Gas Companies are also contemplating amalgamation. Birmingham and other gas undertakings are seeking manufacturing powers over additional lands. There is another Joint Burner Bill; and a joint application by various companies for powers regarding benefit funds. A few purchase schemes are to be considered; and, if the Salford Corporation cannot agree (as they are still trying to do) with the outside authorities, on the subject of the appropriation of gas profits in aid of the rates, there should be a good fight over this matter. The outside authorities have the Corporation in a corner, from which they cannot escape—the former having promoted a Bill, one purpose of which is to give them relief from the contribution to the rates of Salford through the profits made in their areas. The Bill in other respects gives Salford powers, for which they have also a measure in Parliament.

Legal.

Looking over the legal record of the year, there has not been much of moment before the Courts in which principles are concerned, or which present anything of a critical nature. The usual crop of prepayment meter robberies, stealing gas, and so forth, and proceedings in connection with the financial failures of company promoters have been chronicled. Two or three cases of falsifying the books of gas undertakings have been in Court; but fortunately the gas industry is not prolific in instances of such disloyalty and dishonesty. There have been a few workmen's compensation cases in the Courts for decision; and, in association with these, there is one thing of which we are particularly pleased—that is, that the results almost without exception show that the gas undertakings concerned were justified in resisting the claims. As a rule, gas managements are not inclined for litigation with their employees unless they feel they are being imposed upon, or that a question of principle is at stake upon which they would like the decision of the Court. In the case of a charge preferred of stealing gas—*Maas v. Gaslight and Coke Company*—the latter had to pay damages over, in the opinion of the Court, an error of judgment. There was another case in which a woman engaged as a help by the tenants of a house, in which was a gas-cooker, brought an action for damages, caused by an explosion. In this case the Gaslight and Coke Company were joined as third parties. The plaintiff did not succeed, as it was proved that the stove was not defective when supplied, and there was no evidence of negligence. In the case of *Foster v. Charing and District Gas Company*, the matter in dispute was as to the pollution of a stream and the destruction of fish by a discharge from the gas-works. The plaintiff succeeded—an injunction was granted, and an inquiry as to damages was directed, the Company to pay the costs of the action. The Redhill Gas Company appealed from a decision of the local magistrates who had convicted them, and inflicted a penalty upon them, for opening a road for the purpose of laying a main without giving notice to the District Council. The road in question was a highway; but it had never been taken over, or become reparable by the inhabitants. The appeal resulted in the conviction being quashed. An interesting case was that of *Schweder v. Worthing Gas Company*. The plaintiff had built a tunnel—partly, Mr. Justice Eve said, for the purpose of making his property more accessible, and partly to thwart the Company from laying mains. The judgment showed that the Company had not acted *ultra vires* in constructing the main in the

way they had done; but at the same time the plaintiff had been the victim of a trespass. An injunction was therefore granted; but it was suspended to enable the Company to consider the question of an appeal. The plaintiff himself has applied for a new action; and the matter is to come up again next month. An action was brought against the Tottenham and Edmonton Gas Company in regard to a tar contract; but it was proved that the contract was not one for the sale of tar fit for tar paving, nor was the constitution of the tar guaranteed. There was judgment for the Company, with an allowance to the plaintiffs for an excess of water. An action as to the infringement of the Gunning street-lamp controllers, in which Metropolitan Gas-Meters, Limited, were the defendants, ended in a verdict in favour of the latter. A "gassing" fatality through the inhalation of poisonous fumes while working in a culvert has led to a claim by the Rochdale Corporation against the Trustees of the Rochdale Market Company for money paid as compensation and costs to the representatives of one of the men who died. The issue is as to whether the fumes from the exhaust of an engine or sewer gas were responsible. Judgment has yet to be delivered. Penalties in connection with contracts have brought Messrs. C. & W. Walker into collision with the Bilston Gas Company. The defendants won; but there will probably be an appeal.

A *cause célèbre* was that in which the Municipal Council of Johannesburg made a heavy claim against Messrs. D. Stewart and Co., Limited, of Glasgow, Mr. William Beardmore, and others, for damages for failure in their contracts in connection with the supply of gas producer plant, engines, and plant in connection with their electric power station. The Municipality were awarded £340,000 damages. Various cases have been heard in which rights concerning shares and debentures have been in Court. The "JOURNAL" has also been involved in an action for libel, in connection with the operations of Louis Dosteel (trading as the Incandescent Supply Syndicate) in trying to persuade the public to take up the business of gas-mantle making at home. The plaintiff's views were best expressed by his non-appearance in Court. There have been several successful appeals during the year in the matter of allowance for depreciation in respect of income-tax; allowances granted taking the lines of 5 per cent. for machinery and retort-benches, 2½ per cent. for gas-mains, and 10 per cent. for meters and stoves.

The Edinburgh and Leith Gas Commissioners have been engaged in a valuation appeal; the question raised being as to whether landlord's taxes and feu-duties ought to be deducted from the sum brought out by the approved calculations before the valuation was fixed. Judgment has still to be delivered. The Malton Gas Company were successful in an assessment appeal; and the expenses of the appeal fell upon the ratepayers. The Leeds Corporation appealed against a decision of Mr. Justice Hamilton in regard to a question of assessing for income-tax a sum of £78,000 on which tax had already been paid by the various municipal undertakings, which virtually meant claiming the tax twice. The Court of Appeal were in favour of the Corporation. There have been arbitration proceedings in connection with the purchase of the Kirkcaldy, the Swinton and Mexborough, and the Mallow Gas Companies' works. The award in the Fraserburgh case has been published; it amounted to £27,608, including stocks. In the case of Swinton, the award was £60,370, including mortgage debt and other liabilities. In the Kirkaldy case, the net price paid by the Corporation was, including interest, £141,913. Information was given in regard to this matter last week.

LABOUR TOPICS.

One of the most peaceful sections in the labour world has been that connected with the gas industry. But generally the year has seen, and the country has most acutely felt, a tumultuous condition of things in association with labour the like of which is unprecedented. Admittedly, the cost of living has increased; employers are in many cases voluntarily recognizing this. In many quarters—in London, in Sheffield, and in suburban and other provincial places—this has been recognized by the administrators of the gas industry, and increased payment to employees made. But the cost of living varies in different places; and this must not be overlooked by the men as an important factor in the consideration of this matter. But in the railway world and in other industries, the year has seen a widespread revolt against law and order; and agreements have been largely violated by employees. Conciliation and arbitration, too, have been found, while useful in the settlement of comparatively small disputes, to be wanting in the composing of greater ones. The Government nevertheless have set up an Industrial Council with the view of strengthening the conciliation and arbitration machinery for preventing strikes, and of investigating matters affecting disputes. We hope the Council will succeed; but both conciliation and arbitration, the leaders of the Trades Unions preach, are opposed to the principles of trades unionism. What they want is more "recognition" by employers; they want to hold unimpaired the power of the strike; they have learned the power of striking *en masse*, instead of piecemeal or locally. Anything that affects the militant side of trades unionism, the leaders hold, is antagonistic to their rights and privileges, and thus weakens their power.

All this and a great deal more has been forced upon the people of this country this year by, first, the dockers and carters strikes, and then the railway and other strikes—with all the enormous waste, paralyzing of trade, inconvenience, trouble, and anxiety caused to the country. The details of these grave matters are only too well in the minds of our readers to even need brief outline. The inquiry by a railway commission succeeding the strike of the railway men, the repudiation of the findings of that body by the men, and the ultimate settlement are quite fresh in memory. The long-continued and wasteful trouble in the Welsh coal-fields, and unrest in the coal-fields generally, largely through the Coal Mines (Eight Hours) Act, have cast heavy shadows over the country; and until almost the close of the year, there has been fear and trembling lest a universal coal strike should be declared in the midst of winter. There is a little respite from anxiety; and yet we are not, at the time of writing, "out of the wood." The men and employees, as we have stated earlier, have been in conference over, *inter alia*, a district minimum wage. No settlement has been effected; and a ballot of the men is to be taken. All is not well in the coal-fields. During the great strike at Liverpool, the employees at the electricity station left work; and the supply of current was cut off. The electricity industry are now trying to get the same protection applied to their undertakings as is possessed by gas and water works under the Conspiracy and Protection of Property Act. A Labour Disputes Bill was introduced into Parliament during the session; and one of the Socialist members brought forward a measure for the establishment of a Ministry of Labour. But they have not so far matured.

In his address as President of the Labour Co-Partnership Association, Mr. Corbet Woodall stated that capitalists were not altogether blameless in this matter of labour unrest; they had not struck at the root of the trouble. In the gas industry, the great scheme of co-partnership of Sir George Livesey has been found efficacious in binding together the interests of master and employee. Among gas companies there are new adherents to the principles of this beneficent system—notably Plymouth and Harrow. Since Sir George introduced the scheme at the South Metropolitan Gas-Works, the sum of £686,237 had been, by the end of 1910, divided among employee co-partners; and the capital held by them amounted to nearly £598,000. In America, the men of the Boston (Mass.) Gas Company have had the privilege of electing their first employee Director. Mr. Charles Carpenter carried the message of co-partnership the other week into the Oxford University, by opening a discussion upon it there. Since then the statue of Sir George Livesey at the Old Kent Road works of the South Metropolitan Gas Company has been unveiled by Earl Grey. The labour storms of the year have directed greater attention than ever to what is being done in the gas industry in the matter of co-partnership. By the way, the European Gas Company have carried through a scheme by which a stronger tie is created between them and their employees.

There were short strikes of gas workers abroad in Sydney, Milan, and Lisbon, and threats elsewhere. A Union in the Manchester district spoke of bringing out the Manchester and Salford municipal employees, unless non-unionists were dismissed; but the Union appeared to have spoken without any definite mandate from the municipal employees.

OFFICIAL AND ADMINISTRATIVE CHANGES.

The year has been busy with official and other changes; but we will only refer to a few of the principal ones. Among the retirements are noticed those of Mr. J. H. Brown, from Nottingham (succeeded by Mr. John Wilkinson); Mr. S. W.

Durkin, from Southampton (only just before his death), and he has been succeeded in his official position by Mr. Frank Durkin; Mr. W. W. Hutchinson, from Barnsley (succeeded in the engineership by his eldest son, Mr. Harold Hutchinson, and by Mr. T. W. Roystone as Secretary); Mr. Joseph Morris, from Jersey (succeeded by his son); Mr. A. W. Onslow, from Woolwich; Mr. Henry J. Smythe, from Maidstone (succeeded by Mr. Frank Livesey); Mr. J. C. Watson, from Calcutta (succeeded by Mr. L. M. Snelgrove); and Mr. H. D. Ellis retired from the Secretaryship of the Commercial Gas Company. On the amalgamation of the Chigwell, Loughton, and Woodford Gas Company with the Gaslight and Coke Company, Mr. F. Smallbone has elected to retire. Among other official changes, Mr. F. J. Bywater goes to the East Greenwich works of the South Metropolitan Gas Company in succession to Mr. Joseph Tysoe; Mr. Bernard F. Browne transfers his activities to Santos; Dr. W. B. Davidson has been appointed Engineer of the Nechells works of the Birmingham Corporation, and Mr. W. Chaney of the Saltley works; Mr. George S. Eunson received the appointment of Engineer and Manager to the Northampton Gas Company. Mr. A. B. Stedman has been selected for the Secretaryship of the Reading Gas Company; and Mr. Edwin Upton for the Treasurership of the Liverpool Gas Company. Mr. J. P. Valon is on his way to Singapore as an assistant; and Mr. Sidney Smith has left Bolton to take an appointment abroad. Several changes have been made in connection with the Gaslight and Coke Company's stations (*ante*, p. 816). Among directorial appointments, Mr. Frank H. Jones and Mr. Laurence S. Rostron have been elected to the Board of the South Metropolitan Gas Company; and Mr. H. D. Ellis to that of the Commercial Gas Company. Mr. W. S. Smart has been appointed General Manager of Messrs. W. J. Jenkins and Co.'s Retford works.

Broken Links.

The death roll of the year has been a heavy one. Many of the links with the past and old associations have been snapped. Many faces have passed from our vision (tho ugh not from memory), and from the activities of the industry. Among those who have passed from the official ranks are: Mr. H. W. Amos, Mr. Henry Birch, Mr. John Lees Cocker, Mr. W. M. Cowie, Mr. S. W. Durkin, Mr. Charles Elliott, Mr. Raphael Herring, Mr. Charles Panchen, Mr. G. E. Saville, Mr. John H. Strange, and Mr. W. B. Whitaker. Mr. H. Leicester Greville, whose name stood high in esteem for his work in gas chemistry, has gone from our midst. The Board of the South Metropolitan, the South Suburban, and the Monte Video Gas Companies lost their valued colleague Mr. Robert Morton; the first-named Company, Captain T. B. Heathorn; the Board of the Commercial Gas Company, Mr. John Giles Pilcher; the Mitcham and Wimbledon Gas Company, Mr. J. J. F. Stevens; the South Shields Company, Dr. J. F. Armstrong; and other Companies, to them, equally esteemed participators in administration. A prominent light in municipal gas circles has passed from sight by the death of Alderman Gibson, the Chairman of the Manchester Gas Committee. The inventive, manufacturing, and contracting worlds in which we are immediately concerned have lost men whose work was monumental and good, or excellent in its practical worth. Sir John Aird ended a life of large engineering and constructive deeds; and others were: Mr. George Bower, Mr. J. W. Bray, Alderman Joseph Brown, Sir W. J. Crossley, Mr. W. J. Jenkins, Mr. Frederick Lennard, Mr. Henry Perry, Mr. George Robson, Mr. William Russell, Sir Samuel Sadler, Mr. A. H. Wall, and Mr. E. Sugg-Wright. The bearer of a well-known name in the coal world—Mr. Ellis Lever—has passed away. We mourn with our German friends the loss, among others, of Herr Emil Blum and Herr Georg Buhlmann.

Accidents.

There have been various accidents on gas-works; but the fatalities have not been extensive. In the majority of cases they have not been associated with the processes of manufacture, excepting purification; and to the occurrences connected therewith we have referred elsewhere. Mostly other accidents have been in connection with the incoming or outgoing of material, or on structural works. A number of large explosions have taken place in factories, and some alarming ones in streets; but town gas has fortunately not been a participator. The causes have been traced to the manufactures conducted in the factories, or in the case of the street explosions chiefly to the fusing of electric cables, and the generation of gas from the bitumen covering. There have been explosions in which town gas has been concerned; but they have not been extensive in number or heavy in their effects. The number of gas suffocations and suicides has not been so great as we have had to record in some recent years; and for this there is cause for thankfulness, though the gas industry cannot help the latter, nor can it do anything to prevent the negligence of people over whom it has no control.

This closes the chapter of the Year's events—a chapter that only lightly delineates the fresh contribution to the history of the industry. From the record, we look forward. For the industry, the prospects are bright, and full of promise. Business is good; the applications of the primary product are increasing; and the means of use improve in efficiency. The conveniences of that product are appealing more and more to the public. The markets for residual products maintain a good tone. If there is anything that will cause any retardation in the fulfilment of all our hopes, it will be of external and not internal origin. With the position well before us, we have confidence in, and with deeper feelings than the promptings of mere conventionality, again wishing all our friends of the industry—

Much Happiness and a Plentiful Prosperity in the New Year.

The Final Cantor Lecture.

Professor Vivian B. Lewes had, at the fourth and final of his Cantor Lectures at the Society of Arts last Monday week an excellent audience, both in number and character. For most part, it was composed of men practically interested, through their daily work, in the problems of carbonization; and they followed with intensity of interest the popular lecturer as he pursued—by analysis and synthesis, and the other properties that the scientifically trained mind has at disposal for examining problems and arriving at solutions—his subject to the end. Of all carbonizing systems before us to-day for gas manufacture, Professor Lewes favours the continuous vertical retort; but he is not prepared to advise that horizontal retorts should, worked according to new methods, be sacrificed to make place for the continuous verticals before their useful life is ended. But Professor Lewes is not satisfied that the continuous retorts as we have them to-day represent finality. The direction in which he is looking is a step onward, and that step is indicated by the method of charging adopted in the old Settle-Padfield retorts—which method gave free space above the charge, and yet, the larger proportion passing off quickly, a comparatively cool exit for the gas. We will return to the lecture in our editorial columns next week; those columns being in this issue occupied by a retrospect of the year.

Coal Miners' Ballot.

The militant section of the Miners' Federation of Great Britain last Thursday obtained their desire. They are impatient to try the effect of coming to close grips with the coal owners over the matter of a district minimum wage for men and boys working underground, instead of continuing to proceed by the more prosaic lines of negotiating with the Owners' Federation. The country may take it for granted now that in almost all the trades unions the socialists and firebrands are in the ascendant; and because they are what they are, and their policy is what it is, they are able, through their subtly enticing influences, to get a larger following than those who possess more moderate views. It thus comes about that a ballot of the whole of the coal miners of Great Britain is to be taken on the subject of a national stoppage to endeavour to bring about compliance with the demand for a minimum wage. Fortunately the continuity of coal deliveries will not be imperilled until the end of February, except in so far as a rush to stock may cause some congestion in the matter of transport. The ballot will be taken from Jan. 10 to 12; and the returns are to be in the hands of the General Secretary of the Federation by Jan. 16. If there is a two-thirds majority, then notices will be given to stop work by the end of February—always providing that there is not prior agreement. Though the Owners' Federation have conceded the principle of a minimum wage, there does not appear to be unanimity among them in the

districts; and there is no doubt that their views and those of the miners vary as to what would be the proper minima for the different classes of work.

Prospects.

The prospects of obtaining the two-thirds majority in favour of a stoppage are unfortunately favourable; for South Wales, Northumberland, and Scotland are almost solid in favour of a strike. At the bottom of their ill-feeling over their conditions is the Eight-Hour Act—especially in Northumberland, where the owners have established the three-shift system, to which the miners object. It is something to be thankful for that the stoppage was not hastened forward, so as to have caused trouble at Christmas time. The railways and gas companies are reported to be well stocked; but it is impossible to say this is universally the case, as we know that some directors have been ridiculing all idea of a strike on the strength of the views of certain of their coal agents. However, what will happen at the end of February is matter of speculation; but gas companies cannot afford to be unprepared for any emergency.

Collective Bargaining.

Presiding a few days ago at a meeting of the Newport (Mon.) Literary Society, Mr. D. A. Thomas remarked that he did not know whether any district in the United Kingdom had suffered from more stoppages resulting from industrial disputes than had the great area of the South Wales coalfield. The result had been that, during the last four years, the output of the district had fallen by 1,250,000 tons, though 23,000 more men were employed. The employers had for the last forty years recognized to the fullest extent the trade unions in the South Wales coal business; but a difficulty which had been felt in an increasing degree of recent times, in connection with industrial disputes, was the tendency of the workmen to set aside the decisions that had been come to on their behalf by their accredited representatives. The occasion of these remarks was a lecture by Professor S. J. Chapman, M.A., Dean of the Faculty of Commerce in the University of Manchester, upon "Methods of Preventing and Settling Industrial Disputes." In the course of this, the men were urged to maintain the decisions of their leaders, inasmuch as collective bargaining is the great gain of the trade unions in the last century, and, to depart from the decisions resulting from the bargaining, would be to throw away what had been won. But, in the opinion of the lecturer, the present situation is only temporary. It is, he said, remarkable that the series of strikes have been coincident with the high prices prevailing, which are due to the great gold outputs of South Africa. During the last decade, 96 per cent. of the alterations in wages took place without a strike or a lock-out. While admitting that the prevention of strikes by law has met with marvellous success in Australasia, Professor Chapman pointed out that the conditions there are very different from those prevailing in England, and that they must not deduce from the success in the Australian Colonies that the same results would be attained in this country. That is not his solution of the difficulty, for he is of opinion that the instinct of the community in this country is against the introduction of Australasian methods. The right manner of settling strikes, the Professor argues, is to smooth the methods of bargaining; for the whole of the trouble is that particular bargains create friction. It is his conviction that, if the constituted wages boards were put more into action, especially with reference to the Board of Trade, the 4 per cent. of strikes to which allusion has already been made would be reduced to 1 per cent.

Railway Station Lighting.

Every town has its railway station; some large towns and cities boast several. All these stations up and down the country have to be lighted by artificial means when daylight fails. No one will be prepared to gainsay the importance of these places being properly illuminated at night time, and by a system that has the best character for steadfastly performing its functions, and does not suffer from the liability to prompt extinction when the public are using the stations. The Illuminating Engineering Society were discussing the important subject of the principles to be followed in lighting such places at their meeting on Tuesday last, at which Mr. F. W. Goodenough presided. The paper that initiated the discussiou was by Mr. Haydn Harrison, M.Inst.E.E.; and he put the case with the decorous impartiality which is expected from members of the Society, when assembled together in one place, and under the laws governing the Society. There are railway stations and railway stations—stations large and small, important and otherwise in the matter of traffic, and different one from the other in architectural features. In lighting they require different treatment; and therefore few general principles can be applied to them. But it was generally held that the permissible minimum of illumination in the stations in which the streams of traffic are constant should be 0·25 foot-candle; and that the ratio between maximum and minimum should be as low as is reasonably practicable under the conditions to be illuminated. In the smaller stations, the same minimum should apply when the station is being used; the lights being reduced when there are no incoming trains, and no passengers about. This means a light that offers flexibility; and this gas-lamps do in a manner that electric lamps cannot.

Expediency, Economy, and Safety.

Illumination is, of course, very cheap to-day compared with the past; and there is a tendency to make stations more attractive than ever—more especially in view of the competition of tramways and motors between large centres and suburbs. The question of which method of lighting is adopted is not always governed by monetary or efficiency considerations. Expediency, it was pointed out in the discussion, came in. The competition for coal and other traffic has to be considered; and the question of—such as on the tube lines—the ability of generating cheap electric power, and so obtaining cheap current for lighting, is also one among other factors that go to determine the system. But we think that safety should be supreme over expediency. Lives have been lost at ill-lighted stations. Only recently there was an action before Mr. Justice Avory in which a claim was made for damages on account of the station not being efficiently lighted. The accident occurred on a somewhat foggy day; and this led his Lordship to remark upon electric light not being efficient in foggy weather. Public safety as well as efficiency should therefore come in. Of course, the Society must not go into costs—either initial or working, or costs incurred in protecting the eyes of the public from glare, or their bodies from injury. They must keep hard and fast to principles governing the provision of required illumination. But Mr. J. G. Clark, without infringing the rules (as he was merely quoting high-pressure vertical against inverted gas-burners), managed to point out that at the Victoria Station (L.B. & S.C.R.) the change to the latter form of high-pressure lamps had given the same maximum and minimum foot-candles, with an expenditure of 40 to 50 per cent. less gas. This is an important result, which the gas-meter and the photometer refuse to have cast on one side by mere words.

Professor Lewes's Lectures on Coal Carbonization.

In another part of the "JOURNAL" will be found a report of the concluding lecture by Professor Lewes on the "Carbonization of Coal;" and our readers will now be able to appraise the value of the series. The following remarks upon them appeared in the Engineering Supplement of "The Times" (in which good abstracts of the lectures have been given) last Wednesday: "The Cantor Lectures delivered this year by Professor Vivian B. Lewes on the 'Carbonization of Coal' must be regarded as one of the most valuable contributions to descriptive technical literature that the Royal Society of Arts has elicited for some time. It is a subject that touches the industrial world at so many points, that it may be said to dominate all manufacturing processes, and to be a determining factor in most of the arts and crafts. . . . Research students might well be exercised to know which branch of the matter to select for investigation; but Professor Lewes indicated one or two directions in which good work might be done. For example, it would be difficult to find a more hopeful line of research than that afforded by the subtle changes which lead to the formation of resinous compounds during the process of vegetable decay, and the transitions that result in the formation of substances such as amber, coal, and the earth waxes. It is perfectly true that chemists have already done a vast amount of work upon oils, varnishes, and resins, and they have supplied powerful tests for attacking new substances. Their labour, however, amounts to little more than the initiation of a research that is illimitable. The gradual resinification of substances of the india-rubber group may be taken as an example of the practical questions that await an answer. At the other extremity of his lectures, Professor Lewes was able to point to the vertical gas-retort as an illustration of what the gas engineers of the modern school have evolved from a crude idea which Murdoch endeavoured to perfect in his day."

GAS STOCK AND SHARE MARKET.

Owing to the exigencies of the season, which impose upon us the necessity of going to press before the week is fully complete and ended, our review of the operations on the Stock Exchange during that period is somewhat abbreviated. But the brief interval which elapses between the settlement of the mid-December account and the Christmas holidays is almost always a very quiet time; and it rarely furnishes a noteworthy incident or a market movement of any magnitude. The current week is no exception to this prevailing rule. Quiet enough at the opening, it became more and more inactive from day to day; and the attendance became scantier as members closed their accounts and betook themselves to fresh fields and pastures new. The tendency was somewhat variable; but the two chief factors were constant —the hardening of money, and the vagaries of the labour question. The tone at first was rather dull; signs of renewed unrest in industrial circles having a notable weakening influence on Railways. But Home Government issues were in some demand, and Consols responded with a rise of $\frac{1}{8}$. Americans were rather better. Some recovery was apparent on the following day, on brighter views being entertained regarding labour questions; and the gilt-edged division were steady. But as the week grew shorter, realizations increased, and their effect in the Railway Market was weakening; while the stiffening of money caused Consols to lose more than they had gained in the earlier part of the week. In the Money Market, there was a very good demand for short loans; and discount rates stiffened appreciably. Business in the Gas Market was quite on the usual holiday scale. The tendency was one of unbroken steadiness. In Gaslight and Coke issues, the ordinary was done at the old figures, $104\frac{3}{4}$ to $105\frac{1}{4}$. In the secured issues, the preference realized $103\frac{1}{4}$, and the debenture 79. South Metropolitan changed hands at 116 to 117. In Commercials, the 4 per cent. was marked at $110\frac{3}{4}$ and 111. Among the Suburban and Provincial group, Bournemouth "B" marked $16\frac{1}{2}$ and $16\frac{3}{8}$, Brentford old was done at 260, and South Suburban at 122. In the Continental companies, Imperial had dealings at $188\frac{1}{2}$ and 189; and the debenture marked 91. European was done at $20\frac{1}{2}$ and $20\frac{3}{8}$. Among the undertakings of the remoter world, Melbourne 5 per cent. changed hands at 101, Oriental at $134\frac{1}{2}$ and $135\frac{1}{2}$ *ex div.*, Primitiva at $7\frac{7}{16}$ and $7\frac{9}{16}$, and ditto preference at $5\frac{7}{32}$ to $5\frac{5}{16}$.

ELECTRICITY SUPPLY MEMORANDA.

Hampstead's Eye-Opener—Gas-Driven Generating Plants at Liverpool—Dishonest Use of Dr. Meymott Tidy's Ancient Analysis—Humorous Recommendations for a Water-Heater—Discontent—Sluggish Financial Support for the Electricity Bill.

The event of the past week for the electrical industry has been the disclosures made, first to any length in our columns last Tuesday, regarding the unpleasant surprise for Hampstead as to the cost of converting the street lamps from incandescent gas to electricity. An excess of about £10,000 on a £15,000 estimate was bad enough, and gave rise to much local indignation. But on top of it, the fact that the electricity accounts were "tampered" with—"this evident tampering with the accounts is, in the opinion of your Sub-Committee, one of the worst features in this deplorable matter" were the exact words employed by those who made the investigation—in an attempt to hide the true state of affairs, has raised the indignation to a feverish pitch. What is a bit puzzling is that all this could have gone on month after month in secret without the members of any of the Committees of the Council being aware of the fact. The whole incident (if such a term is strong enough) constitutes a severe condemnation of municipal management of an electricity supply concern. The Council, or at any rate part of the body, cannot hold themselves perfectly blameless in the matter, or, if they do, they must feel a depression of dignity over the fact that, for so many months, they have been successfully hoodwinked by those who have fallen victims to, according to the judgment of the Council, their own indiscretion. How anyone could have reasonably supposed that a matter of thousands of pounds of excess outlay could be disposed of by a transfer of charges from their proper destination to improper ones (there is no question whatever of peculation in the matter) is altogether beyond conception.

But for the Council, there is another aspect of the matter. Before this "bolt from the blue" fell among the astonished ratepayers, there was a large amount of dissatisfaction over the quality of the lighting obtained as a result of the change—a change effected at a cost, it was thought, of £15,000. But now that it is known that the indifferent lighting has cost £10,000 beyond, it must be the general opinion that the diversion of the public lighting service from gas to electricity—more especially when the Gaslight and Coke Company offered a greater amount of illumination under a new contract at less cost—is a pitiful maltreatment of public interests for the sake of a municipal trading enterprise. It has before been maintained by high authority that the questions of public lighting and municipal electricity supply should be considered as entirely distinct services. There are other sides to these Hampstead revelations. The ratepayers are not at all pleased that an attempt was made to keep a matter in which they were so intimately concerned as dark as possible. The report giving the details of the investigation (which we find an extremely interesting document) was marked "Private and Confidential;" and every effort was made to veil it from the eyes of the public. Then the meeting of the Council itself at which the whole unpleasant tale was discussed was held with closed doors. Some of the ratepayers do not consider they have been taken into confidence by the Council in this matter in the open way they should have been. However, some of the daily papers have obtained sight of the "Private and Confidential" document, and have, in the public interests, dipped into it. The impression that the revelations will make upon other municipal authorities will not be such as will meet with the approval of the electricity supply industry; seeing that they show that the real cost of the wholesale conversion of public lamps from gas to electricity is not a negligible quantity. It is a penetrating light that Hampstead—a majority of whose governing body went so obstinately and light-headedly, or rather light-heartedly, into this question—has thrown upon the subject. The lesson the majority have had has enabled them to realize how, eighteen months or so ago, they were wandering, with an absurd self-reliance, in obscure and unknown paths; but they have paid the penalty. And no one among them can be altogether pleased.

The scene of discontent with the municipal management of an electricity undertaking shifts to Liverpool. There a proposal is on the *tapis* to spend £100,000 on the re-equipment of the Lister Drive generating station; and last Wednesday the Council were discussing, and agreed to, the first expenditure of £40,000 on new turbine engines. In industry there is no objection to scrapping plant if really profitable economy is to be effected; but judging from matter published in the "Liverpool Post," it seems there is a strong feeling that the management of the concern has not been equal to that in certain other important cities. Both the electrical and the tramway systems are alleged to be costly and inefficient; the gross and net profits, in comparison with other places, low; the number of units sold per head of the population (17·5), also low; and the prices charged, higher than in other cities. But the information published in the "Post" as to the savings effected by large users of electricity by installing private generating plants is, to us, the attractive feature of the controversy. Including all expenses, the Brownhill Workhouse generates its electricity by means of private plant for $1\frac{1}{4}$d. per unit; the energy being used for both laundry work and lighting. Then a private firm calculate that they save, in contrast with the prices charged by the Electricity Department, £2000 a year by having their own suction-gas driven plant. A large hardware company put down, five years ago, private plant, with gas-engine drive, for lighting. The total costs work out to about half of the Electricity Committee's charges; and the savings in five years have paid for the plant. A manufacturing engineer in the city informed the "Post" that he had superseded electric motors supplied from the city mains by gas-engines—the relative costs for doing the same work, at city prices, being 30s. per electric motor as against 12s. per gas-engine. A large sawmill proprietor, who formerly used the public electricity supply, also declares that he is saving a large sum yearly by having changed over to gas-engines. An electrical engineer practising in Liverpool likewise asserts that, at the price of current for power purposes, the gas-engine was right "on the top." This and other testimony shows that gas-driven private plant is worth the consideration of large users of electricity for power and lighting; and that the gas-engine, in comparison with the electric motor, where the one is as good as the other in the matter of convenience, is more economical in the factory.

The South Metropolitan Electric Light and Power Company, Limited, ought to be heartily ashamed of themselves. They have issued a booklet in their area of supply entitled "The Ideal Home." We get no further into it than the second page of the wrapper; and there our attention is arrested by some tabular matter headed "A Striking Comparison." We there read: "The following analysis by Dr. Meymott Tidy shows the quantities of oxygen consumed, carbonic acid generated, air vitiated, and heat produced by gas-oil, and candles." That the analysis of Dr. Tidy should be made use of to-day in this way shows the dearth of reasonable argument the electricians have to put forward, and the methods they find it necessary to adopt to try to discredit gas. In the early weeks of 1892—twenty years ago—Dr. Meymott Tidy drew his last breath; and the analysis now quoted was made long before that, when gas lighting was, compared with the scientific refinements of to-day, conducted by relatively crude means, and absolutely different conditions prevailed. The tests were made with flat-flame burners, giving a light of only 12 candles for a consumption of 5 to 6 cubic feet of gas. The basis of Dr. Meymott Tidy's tests was "gas burned to give a light of 12 standard candles;" and he found that this luminous flame required 5·45 cubic feet of oxygen. Now if we reduce the duty of a low-pressure inverted burner to the same standard, the production of a 12-candle light requires the consumption of $\frac{1}{2}$ cubic foot of gas, which would for complete combustion require about 2·6 cubic feet of air, of which 0·52 would be oxygen. Need we go farther in the exposure of such false representation as we have in this statement in "The Ideal Home," issued, we believe, partly in the districts of the South Metropolitan Gas Company, the South Suburban Gas Company, and the Bromley Gas Company by the South Metropolitan Electric Light and Power Company? Such dishonesty is enough to make Dr. Meymott Tidy rise from his grave, and protest against any such use of his ancient

figures. Has anyone in the South Metropolitan Electric Light and Power Company, Limited, ever considered the amount of air and oxygen consumed by the fires under their boilers at the generating-stations; and yet the attendants live. Or have they considered the amounts consumed by their own domestic coal fires; for we hazard the opinion that all the directors, officers, and members of the staffs of the Company have not adopted electric radiators, electric cookers, and electric water-heaters throughout their homes. If they have, they must be remarkably well paid by the Company, and must also be endowed with the patience of Job.

We do not know whether a Christmas joke is being perpetrated on the recipients of a circular referring to the "Bankside" water-heater, which is described as a labour-saving appliance for hotels and private houses. If not, then the statements in the circular (a copy of which has come to hand) are most humorous. The boiler, it is stated, will hold "nearly" 1 gallon of water, which, at boiling temperature, is "sufficient to provide hot water for washing purposes for six to eight persons." The dimensions of the persons are not stated; but in this sanitary age, we would rather not know the eight persons who would regard less than 1 pint of hot water sufficient for their ablutions. The boiler objects to these six or eight persons picking and choosing their own time for attending to the duty of personal cleanliness. It prefers to do things in a leisurely fashion, and not to wear itself out through being harassed in any way. "The time required to reach a boiling temperature, with a boiler filled, is approximately *three-and-a-half hours*"—the energy consumed being "about" half a unit. We make it more than half a unit, at 160 watts per hour. But there is hope. "Smaller quantities of water may, of course, be heated up in less time." The apparatus appears to be hyper-sensitive as to its respectful treatment. "Of course," we read, "it should be allowed to cool down before being re-filled." Its conceit extends to the belief that its attractive merits should find for it a "ready sale;" and owing to its solid construction "electric supply authorities can safely offer it on hire at a low rental." We quite believe it, but should advise the supply authorities to enter into a written agreement with the users that they should keep their appliance and their tempers for a good term of years, and not molest the former in any way, on account of its grave and sedate methods of rendering service. These are not our advertisement columns; but the spirit of goodwill being upon us, we willingly mention the price of this water-heater, in case any of our readers would like to purchase. A "low" hire rental has been spoken about. This "nearly-1-gallon" heater is supplied for £3 3s. For single heaters, a trade discount of 5 per cent. is allowed; 7½ per cent. for taking six; 10 per cent. for taking twelve; 15 per cent. for taking twenty-four; and 20 per cent. for taking forty-eight. We shall be pleased to give, on being informed, free circulation to the name of the electricity undertaking that has the boldness to order 48 at one time, in order to obtain the 20 per cent. discount. But the price named is not all. It is apparently well to have spare "insertion heaters" at 12s. 6d. each net. Another inducement is a further cash discount of 2½ per cent. for payment within fourteen days. We had almost overlooked this concession; and also the one that in the London district carriage is free. Well, this is Christmas time. We wish the manufacturers—the City of London Electric Lighting Company, Limited—all the luck they can reasonably expect from the "Bankside" water-heater.

Some of the members of the county borough of Stoke-on-Trent do not appear altogether happy over the financial position of their electricity undertaking. Alderman Malkin has called attention to the fact that the amount invested in the works is £240,000; while the gross profits for the last financial year were only £16,300. Of this, repayment and interest absorbed £14,770; leaving a net profit, on a capital of a quarter of a million, of only £1554. This would not matter, seeing that the trading concerns of the Council are not allowed to contribute anything to the rates, if it were not that nothing can be traced in the accounts as having been put aside for depreciation. The concern is evidently run with prices cut very close. However, the matter is to be investigated.

The municipal electricity undertakings are not tumbling over each other to give financial support to the Bill promoted by the Incorporated Municipal Electrical Association to confer extensive powers on local authority purveyors of electricity. So far, the definite guarantees only amount to a little over £700; but with other sums recommended, the total will reach (if the proposals are confirmed) £1000. When the measure was under notice a fortnight ago, we mentioned that the Association were asking for a guarantee of £3000. Will they get it?

Separation of the Constituents of Gaseous Mixtures.—A French patent has been taken out by M. Mazza for a process for separating the constituents of gaseous mixtures. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the mixture is forced very rapidly through curved passages, and collected in two or more portions at different distances from the centre of curvature; the heavier gases being forced by centrifugal action towards the outer part of the curve. One form of apparatus comprises a casing divided into two parts by a horizontal partition. The gases from the lower compartment pass through short bent pipes mounted on the partition, and a horizontal plate in the delivery end of these pipes directs the heavier gases into the upper compartment, while the lighter ones pass to a horizontal outlet channel.

PERSONAL.

NEW APPOINTMENT FOR DR. A. C. HUMPHREYS.

We are pleased to learn, from the last number to hand of the "American Gaslight Journal," that Dr. Alexander Crombie Humphreys, whose name has for some years been associated with that of Mr. A. G. Glasgow in the business of constructors of water-gas plant, has been elected President of the American Society of Mechanical Engineers. In introducing him to the members, at their meeting on the 5th inst., the retiring President (Colonel E. D. Meier) remarked that one of the glories of the engineering profession lies in the opportunities it offers for service to others; and of this truth Dr. Humphreys' career was a notable example. He then gave the following sketch of the new President's career: He entered the Stevens Institute of Technology in 1877; and soon after graduation became Chief Engineer of the Pintsch Lighting Company, of New York. In 1885, he was made Superintendent of Construction for the United Gas Improvement Company, and shortly afterwards took the position of General Superintendent, with headquarters in Philadelphia. Eventually he assumed control of the entire commercial management of all the Company's works, including the Welsbach Company, which at that time was a subsidiary of the United Gas Improvement Company. In August, 1894, he retired from his official relations with the Company to establish the firm of Messrs. Humphreys and Glasgow, of New York, which has recently been succeeded by the firm of Messrs. Humphreys and Miller, of which he is President. In June, 1902, he was elected President of the Stevens Institute of Technology, by the unanimous vote of the Trustees. In 1903, the degree of Doctor of Science was conferred upon him by the University of Pennsylvania, and the degree of Doctor of Laws by the Columbia University. The New York University also conferred the degree of Doctor of Laws in 1906, and the Princeton University in 1907. Dr. Humphreys has been the chief executive of more than thirty-five gas and electric light companies, and is now President of the Buffalo Gas Company. He is a member of almost every prominent technical society in America, and of many clubs and philanthropic organizations, to all of which he gives liberally of his time and his strength. "In assuming the duties of President of the American Society of Mechanical Engineers," said Colonel Meier, "he is adding greatly to his present responsibilities; and yet, such is his capacity for service for others, we who know him know that the affairs of the Society will be in as sure and safe hands as ever before, and that the Society is fortunate indeed in having him for its President during the year to come." Replying to these remarks, and acknowledging the honour conferred upon him, Dr. Humphreys alluded to the heavy responsibility involved in accepting the presidency of the Society, especially in view of the division and subdivision of the engineering profession into so many specialities. In this connection, he referred to a movement recently inaugurated in the Society to provide studies and papers on the many industries which might be considered as related to the profession of mechanical engineering.

Mr. A. G. Lofthouse, of the West Hartlepool Gas-Works, has been appointed Manager of the Quaker's Yard Gas and Water Company, Limited, applications for which position were invited in the "Journal" towards the close of last month.

The President of the Board of Trade has appointed Mr. George Warner, Barrister-at-Law, of the North-Eastern Circuit (son of the late Mr. W. J. Warner, of South Shields), to be a Commissioner for the Holding of Inquiries under the Boiler Explosions Acts, in succession to Judge A. P. Longstaffe, resigned.

Mr. H. W. Philps, of Bournemouth, has been appointed Chief Draughtsman at the Saltley works of the Birmingham Corporation, in succession to Mr. W. S. Smart. Mr. Philps was formerly in the drawing office at Saltley; but on the retirement of Mr. Henry Hack, he went to Nechells. He relinquished his position there to take the appointment at Bournemouth.

Mr. C. M. D. Belton has been appointed Assistant Engineer and Secretary of the Shrewsbury Gas Company. He is a son of Mr. J. C. Belton, the Engineer of the Chester United Gas Company, and nephew of Mr. W. Belton, the Engineer, Secretary, and Manager of the Shrewsbury Gas Company. He was educated at the King's School, Chester, and served his apprenticeship with West's Gas Improvement Company, of Manchester.

The Cleckheaton Urban District Council have appointed Mr. A. L. Jennings their Gas Engineer, in succession to Mr. G. H. Niven, whose retirement on account of ill-health was recently announced. The gas-works there are about to be remodelled. Mr. Jennings served an apprenticeship to constructional engineering with Messrs. Clayton, Son, and Co. Since then he has had five years' experience as Assistant Manager at the New Wortley works of the Leeds Corporation.

This Christmas, Mr. John Chew enters the fiftieth year of his management of the Blackpool Gas-Works; and though he is now upward of eighty years of age, he still takes an active interest in the administration of the undertaking he has controlled for so long. When he went to Blackpool on Christmas Eve, 1862, the price of gas was 5s. 10d. per 1000 cubic feet, and the owners of the works were losing money even at this figure. In the succeeding seven years, Mr. Chew turned a losing concern into a paying one; and then the Local Authority acquired the undertaking. At

first, Mr. Chew had only about eight or ten men under him; and in those days he had to do his own book-keeping. Now there are 180 men employed on the works; and their capacity has increased from 10 millions to 580 millions per annum; the number of consumers has risen from about 800 to 14,000; and the price of gas has been brought down to 2s. 2d., besides the handing over of large sums from profits in relief of the rates. Mr. Chew believes in the future of the gas industry, despite the keen competition of electricity. He says two important changes are pending—the extended use of high-pressure gas, and the cheapening of gas for heating and power purposes. In his opinion, gas will be much more utilized in the future for the purpose of supplementing coal. With gas sold at 1s. 6d. per 1000 cubic feet, there would, he says, be something like fair competition; and this could be done by many municipal gas undertakings if the present policy of making big profits so as to relieve the rates were abandoned. At Blackpool, 6d. profit is taken for rate relief. Therefore, if the Gas Department were relieved of this, gas could be sold at 1s. 8d., with the result that there would be a largely increased consumption for all purposes.

OBITUARY.

The death occurred at Perth last Tuesday, in his 66th year, of Mr. ALEXANDER DAVIDSON, the Water Engineer to the Corporation. He obtained the appointment in the early nineties; and during his tenure of the position he effected several important improvements in the water supply.

The death occurred last Tuesday, at the advanced age of 96, of Mr. CORNELIUS LEA WILSON, of Village Place, Beckenham. Deceased was formerly one of the Directors of the South Suburban Gas Company; and at the half-yearly meeting in February, 1908, he retired by rotation, but offered himself for re-election. He had then been on the Board for upwards of forty years; but as he was in his 93rd year, and had not been present at a meeting of his colleagues for four years, and would not, on account of the state of his health, be able to attend again, it was deemed advisable that he should not retain the position. He was a Justice of the Peace, and owned a large area of land in Beckenham, including the greater part of the High Street.

AMERICAN GOVERNMENTAL REGULATION.

Some Recent Instances.

[COMMUNICATED.]

THERE has recently been held in one of our western cities a judicial hearing to determine the reasonableness of a reduction in gas rates ordered by the municipal authorities. The city was represented by the two "experts" who have monopolized the rôle of civic defenders in cases of this kind. One of these men has had no connection with the gas industry except for very casual employment in three gas-works. His cross-examination reveals an astounding ignorance of elemental facts of the profession for which he attempts to qualify as an expert. Yet he and his companion, whose knowledge of gas matters is of about the same zero extent, but who is not as easily trapped, appear able to delude city after city into thinking the "labourer worthy of his hire."

I spoke above of these two men as monopolizing the work of city gas experts. With you, there are many well-known consulting engineers and engineers of gas plants whose names continually appear in your pages as giving expert testimony before Parliamentary Committees. With them, there seems no fixity of rôle—in one case, one will appear for the civic authority, in another case for the gas company. All this with no more inconsistency than is compatible with honest difference of opinion. In this country, however, the *city* authorities have, as a rule, been unable to secure the services of any recognized gas engineer. The reason for this may be inferred from a statement made by such an engineer to the effect that, on being asked to act on behalf of a city in a rate case, he indicated his willingness, but said that it was possible his report might not be to the liking of his employers. Thereupon the offer was withdrawn.

I italicize "city," because the State Commissions—of which there are now at least seven—have shown an increasing tendency to employ competent professional advice. In this connection, the city of Chicago has recently learnt a lesson, which, however, is not apt to be long remembered by the class of municipal councillors it enjoys. Desiring to prove that the prevailing gas price of 85 cents per 1000 cubic feet should be reduced to 70 cents—in fact, being practically obliged to prove this, as they (the city council) had been elected on a 70 cent platform—the gas expert of the Wisconsin Commission was employed. Judge with what consternation his report was received, showing in great detail that 77 cents was at present the lowest price affording a proper return to the invested capital of the gas company. In desperation, one of our "city" experts was summoned. He nobly responded to what was expected; for although refused access to the company's records (which had been freely given to the Wisconsin man), he soon reported a scale of charges running down to 68 cents! Of course, any of your readers know that America has not the monopoly of narrow-minded and partizan City Fathers; but at least you do not seem to have so-called experts attempting to defend any gas rate, no matter how unfair.

This same expert some years ago was hired by the mayor of an eastern city for the express purpose of reporting unfavourably on the existing local prices for electricity. He thoroughly satisfied the mayor; and, consequently, when the latter was asked some months ago by another mayor for the name of an expert, our "friend" was promptly recommended. Imagine the dilemma he is in, now that he has found that this last case is in the nature of a friendly inquiry by the city, and that an unfair report advocating drastic price reduction is not wanted. Also, it is recorded that, in making a visit to the gas-works and ascending the holder, he betrayed his ignorance of the distinction between inner and outer lift.

As the instances above related are typical of the attitude of most city governments towards these public utility companies, it is quite evident why the majority of gas companies now subject to State Commissions would probably agree in saying that, while they would rather be free from such control, it is infinitely preferable to the unreasonable attacks they were formerly subjected to by the city authorities. [Perhaps the explanation should be made that, where there is a State Commission, a city is deprived of any right to regulate the prices charged by companies under commission control.] Undoubtedly some companies could, and would, serve the public better if left entirely alone; but it can hardly be gainsaid that, under our best Commissions—such as Wisconsin and the up-State New York—the interests of company and consumer alike the State over are being better conserved than would be the case if there were no Commission.

The Wisconsin Commission, in numerous instances, has ruled that any reduction in prices would work injustice to stockholders, in a few cases has allowed increased charges, and, in general, has seen that all companies make proper allowance for depreciation—a matter hitherto very generally neglected. In short, this Commission has added materially to the stability of gas securities in Wisconsin. At the same time, it has insisted on good service, and has reduced prices, when too high because of poor management or inflated capitalization. As fast as opportunity offers, it is investigating and reporting upon each public utility company in the State, and its reports are always complete and instructive. Recently, it commented rather adversely upon a gas distribution system, as comprising mains of sizes larger than required. This feature of the report was discussed at the last meeting of the Wisconsin Gas Association, and the Commission can learn from the record that its ideas as to main sizes are considered somewhat small. This expression of opinion will have weight in future decisions of the Commission.

As there is every reason to believe that with perhaps the next decade there will be a Utility Commission in every State, and as each new Commission shows increasing tendencies to adopt the policies of existing Commissions, it is fortunate for both the gas investor and consumer that the Wisconsin Commission was one of the pioneers, and is being largely looked to by other States for guidance. Let us hope that each Commission will follow the Wisconsin idea of not trying to manage each company, but only of controlling it, which means no inteference whatever, when company management is good. In the meantime, attempted regulation by cities and arbitrary rulings by some Commissions are productive of tedious and expensive litigation, which in the end will have to be paid for by the gas consumer.

Physical Society's Annual Exhibition.

The seventh annual exhibition of the Physical Society of London, which was held at the Imperial College of Science, South Kensington, last Tuesday, was well attended. There were upwards of thirty stands of electrical, optical, and other physical appliances, some of which were shown in operation. Those in which "JOURNAL" readers are specially interested—notably the gas-testing and other apparatus shown by Messrs. Alexander Wright and Co., Limited—were noticed last week (pp. 815, 817). In addition, it may be mentioned that Messrs. Townson and Mercer, the makers of the gas-testing apparatus of Mr. C. J. Dickenson Gair, Mr. C. Winthrope Somerville, and Mr. P. Hulme Hornby, F.C.S., the features of which have already been described, had a stand. The new model of the holophane lumeter of Messrs. Dow and Mackinney, shown by Messrs. R. & J. Beck, Limited, referred to last week, will measure the brightness of any object from the hundredth of a candle-foot up to 200 candle-feet power. This is an improvement upon the instrument shown last year, of which the range was up to 100 candle-feet only. The Ribbon Metals Syndicate, Limited, showed two machines demonstrating the method of manufacturing ribbon metals and the process of casting continuously thin sheet and strip metal; also samples of various metals, in ribbon, strip, and sheet form, made by the Company's process. The ribbon lead is suitable for making pipe-joints. In addition to the interesting display of scientific instruments and apparatus, the visitors had opportunities of hearing Professor the Hon. R. J. Strutt, F.R.S., discourse, in the Physics Lecture Theatre, on "Electric Discharge and the Luminosity that Survives It." The lecture was attentively listened to, and the experiments which accompanied it were watched with much interest.

BOLT COURT AND ITS ASSOCIATION WITH THE "JOURNAL."

In view of the fact that a large number of the readers of the "JOURNAL" have never had occasion to call at the offices from which it is issued, and are not acquainted with the interesting portion of the City of London in which they are situated—interesting from its association with at least two great literary men of a past time, Samuel Johnson and Oliver Goldsmith—we give below four views of Bolt Court, three of which show it as it was early in the present year, before its appearance was changed by rebuilding operations which are now in progress. Fig. 1 is a reproduction from a print in the possession of the St. Bride Foundation Institute, in which are conducted classes for practical printing. The other illustrations are from photographs taken by students of the London County Council's School of Photo-Engraving and Lithography, who made all the blocks, for the use of which we are indebted to the Principal of the School, Mr. A. J. Newton, who has also courteously supplied a few of the particulars that are given below.

Taking the illustrations in their numerical order, fig. 1 shows the house in which Dr. Johnson lived from 1776 until he died in 1784. These premises were afterwards occupied by Bensley, the printer, who afforded a home for Kœnig, and printed from his power press, in 1811, the first sheet of the "Annual Register, 1810," a copy of which is in the St. Bride Technical Library. The house was partly destroyed by fire in 1807, and entirely in 1819. This is an interesting matter, because here we come into

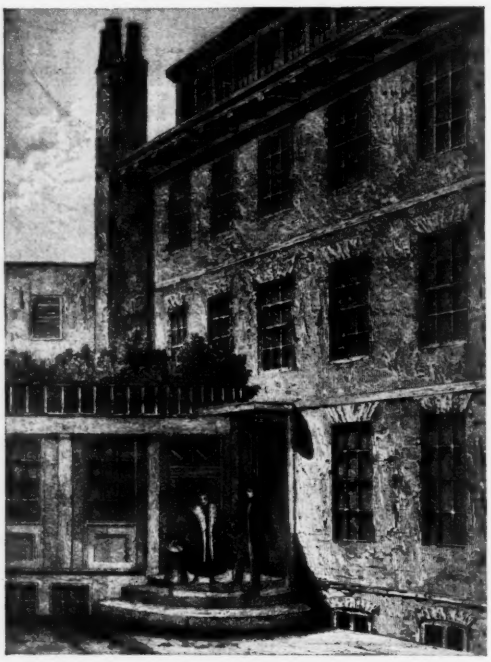


Fig. 1.—House in which Dr. Johnson died.

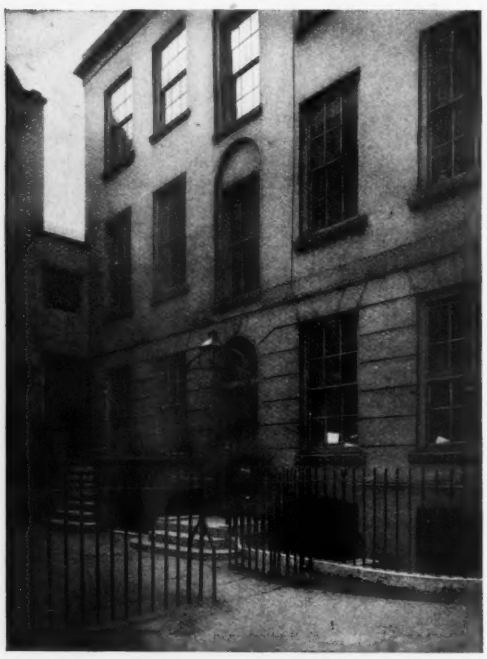


Fig. 2.—London County Council School of Photo. Engraving.

touch with the "JOURNAL." Bensley subsequently carried on his business in Crane Court, a little to the west of Bolt Court, and there, in the office of Messrs. Palmer and Clayton (who, we believe, occupied Bensley's premises), the first number of the "JOURNAL" was printed early in 1849. The original office of the paper was that of the Editor and Proprietor, the late Thomas Greaves Barlow, in Bucklersbury, and the publishing was done in Cheapside. On Mr. Barlow's subsequent removal to Parliament Street, Westminster, about 1855, the same arrangement was preserved. The paper then appeared monthly; but in the first number of the year just named, it was intimated that a possible fortnightly publication would be made, and this was done at the beginning of the next year, when the paper was issued from No. 11, Bolt Court. The house is shown on the right (next to the house with the names upon it) in fig. 3, which is a view looking down the court to Fleet Street; and a portion of it is visible in fig. 4, which is a view looking up the court. The existing building is a reconstructed old house from which, it appears, William Cobbett's publications were issued, as inquiries even now reach us from America and elsewhere for copies. In the background is seen the house in which the work of the London County Council's school already alluded to was carried on from 1894 till a few months ago, when the building was pulled down, and is being replaced by a more commodious one. It will stand on the site occupied by the Stationers Company's School from 1858 to 1893; and the house—a better view of which, showing on the left the entrance to the school, is given in fig. 2—was the one in which the master resided. Two other houses in the court remain to be noticed. The first on the left in fig. 3 is the one occupied for some years by the Medical Society of London. Visitors from the other side of the Atlantic take a great interest in Bolt Court; and this house is sometimes shown to them as the one in which Dr. Johnson died. But this, of course, is erroneous. As will be noticed, there is a tablet on the doorway; but the inscription on it is so weather-worn as to be illegible. Next to this house stood, until recently, the one shown in the illustration. It was some years ago part of the "Dr. Johnson Music Hall," with an entrance from Fleet Street; and it was the nightly resort of the press and literary men who were engaged in Fleet Street. It formed an agreeable counter-attraction to the "Cogers" and other debating societies which in the old days afforded rising lawyers and budding politicians scope for giving expression to their views on questions of the day. The house and the adjoining hall eventually fell into the hands of a sporting club; and the premises have now been pulled down to make way for a modern office building which is in course of erection.

Reference has been made to the change, in 1856, from the monthly to the fortnightly issue of the "JOURNAL." The reason for this was explained in an "Address" to the readers contained in the first number for that year. When the "JOURNAL" was originally started, it was proposed to deal exclusively with matters connected with the supply of gas. But it was soon found that the intimate connection of gas lighting with other social improvements involved the necessity of considering these correlative questions. "The erroneous representations of the prejudicial effects of gas lighting, and the attacks made on gas companies," led involuntarily into the discussion of sanitary matters, with which the water supply and the drainage of towns were intimately connected; and therefore it was decided to devote a portion of the space to these matters. The fortnightly publication continued till the end of 1873; and with the next year commenced the weekly issue—the first number consisting of 32 pages in all, and the first half-yearly volume of 928 pages. In course of time, the volumes increased in bulk till they reached to between 1700 and 1800 pages, and became too large to handle conveniently; and in the year 1903 the present system of quarterly volumes had to be adopted. It literally "speaks volumes" (to use a hackneyed phrase) for the flourishing condition of the gas industry that this change was necessitated by the quantity of matter to be dealt with week by week. The volume closing to-day will about equal in the number of pages the first of the half-yearly series.

Having now disposed of Bolt Court and its association with the "JOURNAL," possibly a few words as to the features of its vicinity may not be out of place. From the top of the court, the pedestrian entering from Fleet Street reaches Gough Square, in which stands, on the west side, the house in which Dr. Johnson lived, and where certainly a great part, and possibly the whole, of the "Dictionary" was prepared. The house has been purchased and is now being prepared for a Johnson Museum. Within a few yards from the northern outlet of Gough Square, to the west, is Newton Hall, in which, we believe, the first meetings of the Royal Society were held; and almost touching it stood, until a few years ago, the house in which Dryden lived. Running parallel with Bolt Court, a little to the east, there is still to be seen, and visited,

Fig. 3.—View looking down Bolt Court.

the world-famed "Old Cheshire Cheese," renowned for its marvellous steak pudding and its association with Dr. Johnson. Just above this tavern, going from Fleet Street, but on the west side of the court, was the house in which Oliver Goldsmith wrote the "Vicar of Wakefield." It was demolished, much to the distress of American visitors, a few years ago. It was from here that, in his impecunious state, he sent round to Dr. Johnson for help; and it was the Doctor's visit in response to the appeal that led to the disposal of the MS. of the "Vicar."

A volume might be written about Bolt Court and its neighbourhood, which of late years has unhappily become a part of what is called "disappearing London." But these few jottings must not close without mentioning that not many hundred yards westward of the court stands the church of St. Dunstan-in-the-West, which occupies the site of one in which worshipped Izaak Walton, the angler, to whose memory a stained glass window has been put in; and a little further westward, in the middle of the road, is the church of St. Clement Danes, which was attended by Dr. Johnson, whose pew is still shown. At the eastern end of the churchyard, facing Fleet Street, is a recently-erected statue of Dr. Johnson. Goldsmith's remains lie under a plain stone on the north side of the church in the Temple, not many hundred yards from the house in which the above-mentioned incident occurred, and still closer to the chambers he occupied in that quiet retreat, "far from the madding crowd" of busy Fleet Street.

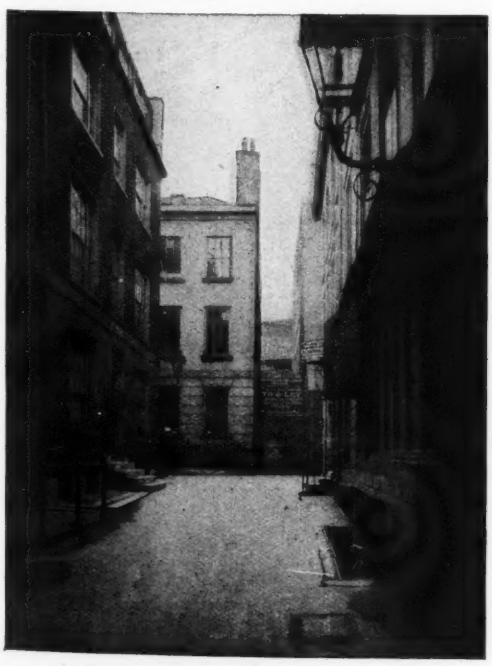


Fig. 4.—View looking up Bolt Court.

NATURAL GAS IN THE UNITED STATES OF AMERICA AND CANADA.

[Communicated.]

Owing to the limitations of environment and the competitive necessity of devoting all available energy to the improvement and development of their own immediate sphere of operations, it is permitted to very few of the gas engineers of the British Islands to have more than a limited acquaintance with that important branch of our great industry covering the handling of natural gas. It was with great pleasure, therefore, that the writer recently undertook a commission to make an investigation into this subject the carrying out of which necessitated a journey through the gas fields of Pennsylvania and Canada; and these notes are intended as a rapid review of the facts and figures then obtained.

After many years spent in balancing the rival claims of various processes claiming to give the highest yield of gaseous products from a ton of coal, as also with regard to the subsequent operations of condensation and purification, it is rather startling to find that in certain parts of the world beneficent Nature has been preparing a much superior article and storing it up in vast reservoirs for the use and benefit of mankind. In these regions, a borehole is all that is required to tap seemingly unlimited supplies of a gaseous fuel of very similar composition to the gas which we manufacture with so much labour and anxiety; while, in addition, it is generally quite free from sulphur compound, and has a calorific power of over 1000 B.Th.U. After a well is once drilled-in, the surface equipment will consist of a valve, perhaps a reducing governor, and, to protect valves and governor from the weather, a small shed about 6 feet square, for a production which may run up to as much as 30 million cubic feet per twenty-four hours.

Magnitude of the Business.

To obtain an exact idea of the magnitude of the natural gas business, it is necessary to turn to the publications of the United States Department of Mines, and the Geological Survey of Canada, from which the combined figures for 1908 can be obtained. It is found that for that year, which is the latest for which combined figures are available, the total quantity of gas marketed in the United States, in round figures, was 450,000 million cubic feet, which sold at an average of about 6d. per 1000 cubic feet, and realized a sum of nearly £11,000,000. In Canada, 8000 million cubic feet were sold, realizing about £200,000; thus giving a total for the two countries of 458,000 million cubic feet, with a value of £11,200,000.

The Canadian output is much smaller than the American, as until this year medium pressure deposits only had been found in Southern Ontario and Alberta. Recently, however, large deposits at high pressure have been discovered in New Brunswick and in Alberta; and the output will most probably increase rapidly in the future.

Origin of the Gas.

Glancing for a moment at the enormous output of gas in the United States, and realizing that this great drain on Nature's resources has been going on for many years, and that the known deposits, apart from any new ones that may be discovered, are estimated as being sufficient to last at least fifty years more, one is driven to ask, Whence comes this vast store? The answer which, in the writer's opinion, best meets the query is that both petroleum and natural gas are products of Nature's wonderful laboratory, derived from chemical reactions which occurred in the central portion of the earth under great pressure, and were projected through fissures in the plutonic rocks and dispersed among the overlying porous rocks, which thus became natural reservoirs. The strata—colloquially called oil or gas sands—which form these reservoirs are either sandstones or limestones, ranging from a thin shell to about 100 feet in thickness, and having an average porosity of about 14 per cent. In one boring, several of these gas sands may be encountered; and it is invariably found that the deeper the geological depth of the strata, the higher is the pressure, which, granted that the volcanic theory of origin is correct, is to be expected. The highest pressure so far recorded is 1500 lbs. to the square inch. It may be accepted that a usual average is 700 to 800 lbs. (say, 54 atmospheres); and the wells visited by the writer carried this pressure. This, of course, refers to the closed-in or rock pressure.

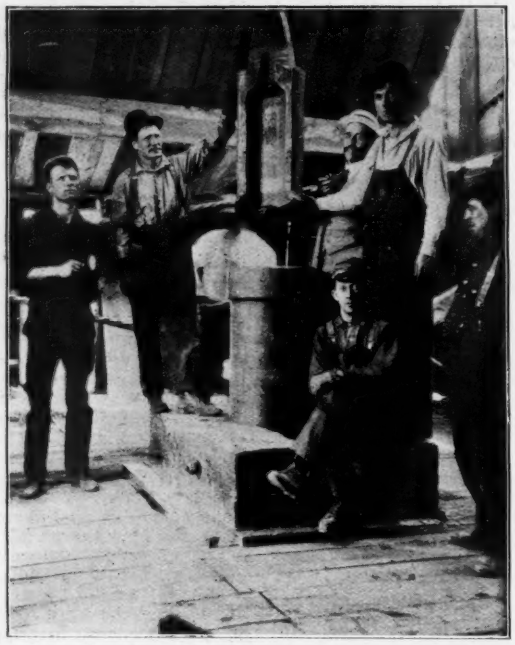
Quantity of Gas Available.

The amount of gas which is stored in the sand is obviously the porosity multiplied by the pressure. Taking 100 cubic feet of sand with 14 per cent. porosity, and multiplying by 54 atmospheres, gives $14 \times 54 = 756$ cubic feet. Then, as there are 27,878,400 square feet to a square mile, the quantity of gas per square mile of sand one foot thick is $756 \times 278{,}784 = 210{,}760{,}000$. The gas sand being anything up to 100 feet thick, and of unknown superficial area, it is easily seen that the quantity of gas available is so vast that the mind cannot grasp the figures. As an example of the immense store, it may be noted that the City of Pittsburgh is supplied by four natural gas companies, all doing about the same amount of business. Of these, one alone supplied last year 30,000 million cubic feet of natural gas, has been doing this for

years, and considers its gas fields contain a reserve sufficient for fifty years to come.

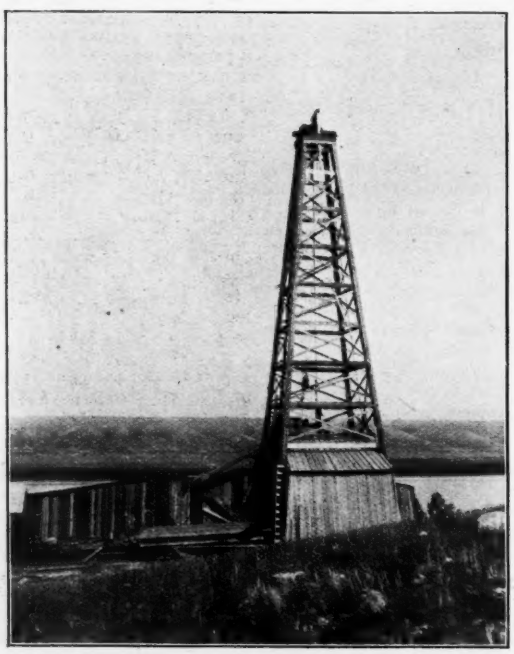
Winning the Gas.

The winning of the gas is by means of tube wells usually drilled with a percussion drill—the size of the initial bore depending on the structure of the strata through which the drill has to



Starting Drilling-in—Showing the 18-Inch Lining Pipe.

pass. The tools used include the drilling bit, auger stem, jars, and rope socket; the whole measuring 60 feet long and weighing about 4000 lbs. The depth of the wells varies in different fields from a few hundred feet to a maximum of 6000 feet, which depth was attained in a well in Upper Silesia in the year 1893. In hard ground which will stand up of itself, a good depth can be drilled ahead of the lining tubes; but in more friable ground liable to cave in, only short lengths can be drilled, and then the lining



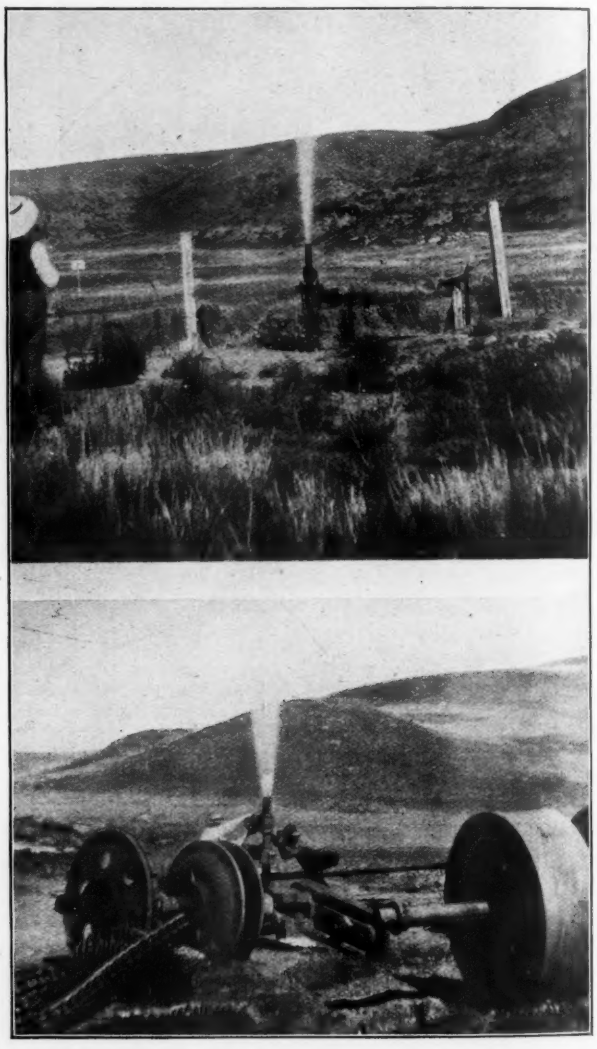
Drilling Derrick.

pipes must be lowered to support the earth. The constant falling in of the sides of the bore in time causes so strong a binding action that the lining cannot be sunk any further, and a smaller size of tube must then be placed inside the one previously inserted, and a smaller boring tool used.

The first well driven in a field of which the condition of the strata is unknown may therefore encounter many difficulties from friable earth or underground water. Experience, however, overcomes all future difficulties; and therefore it is that one new well examined began with an 18-inch diameter tube, inside which, in turn, there were 14-inch, 10-inch, 8-inch, and 6-inch tubes—the latter reaching from the surface to the gas sand 2000 feet below. Accidents, of course, occasionally happen, such as the breaking of the rope manipulating the tools, the breaking of the tools, and faulty pipes, &c.; but ingenious methods have been devised for overcoming such difficulties, which, while extremely interesting, are outside the scope of these notes.

Pipe Line Work.

Having drilled the wells and secured the necessary flow of gas, it has to be brought to market. In a few instances the discovery of a natural gas field has brought a manufacturing town to the neighbourhood of the field; but more often it is a case of piping the gas to the town. Supposing there is a sufficient flow of gas at a high pressure, then the only capital expenditure involved is the purchase and laying of a pipe-line, with automatic governors



Two Views showing the Blowing-off of a 13 Million Well.

at the wells to maintain a regular pressure. There are cases, however, where, owing to the long draft on a well, although the rock pressure may be high, the flow is small, as the gas, in flowing towards the well, has to pass through the minute retarding pores of the sandstone. In such conditions it is necessary to reinforce the pressure artificially. The output of several wells is brought to a pumping-station, where an inlet pressure of perhaps 30 lbs. is raised to an outlet pressure of 120 lbs.

There are a large number of these stations in the States of Pennsylvania, New York, and West Virginia; and it would be supposed that a gas-engine would be used almost universally as the power generator. On the contrary, although there are a few gas-driven stations, the majority of the engines are steam driven; the engineers-in-charge considering the steam-engine more flexible in use than the gas-engine. These stations may be of several thousand horse power, and deal with many millions of cubic feet daily. A short description of two of these will suffice to show the type of machinery in use. The first had a range of ten 250 H.P. Babcock and Wilcox boilers, with superheaters. These boilers were fired with natural gas delivered to the burners at a pressure

of 6 to 8 ounces per square inch. The burners were rather crude, consisting of metal caps covering 1¼-inch pipes having three $\frac{3}{16}$-holes drilled therein. Six of the burners were fitted to each furnace; and the gas was delivered into the furnace by two rectangular fire-brick openings, one at each side, through which also the air necessary for combustion entered. The gas was practically burning directly as it issued from the burners, with the consequence that the furnace was filled with a swirling mass of flame, not entirely free from smoke. The engine-room contained four sets of 1500 H.P. direct-coupled horizontal compound condensing pumping engines delivering the gas at the reinforced pressure of 120 lbs. per square inch. It is interesting to note that the staff required to attend to this plant was represented by one fireman, one engineer, and one greaser per shift.

The second station examined had three 250 H.P. boilers and one 700 H.P. horizontal, direct-coupled, compound condensing pumping-engine. In this case, however, a high-pressure system of gas firing for the boilers was adopted. Fifteen bunsen burners, each consisting of a $\frac{1}{8}$ inch diameter jet, are assembled in a fire-clay block made to fit the mouth of the furnace. The gas is supplied to these at a pressure of 6 lbs. per square inch; and the fire-grate being covered with a layer of broken fire-brick, permitting just sufficient air to percolate to complete the combustion, the interior of the furnace had the appearance of a shimmering mass of heat without either flame or smoke. When once the gas and air supply are adjusted, the amount of attention required by these furnaces is practically *nil*. The stroke of the engine was 48 inches, and the diameter of the pumping cylinder 17 inches. This was double-acting, with steel valves having brass seats. The inlet pressure was 37 lbs., and the delivery 130 lbs. The gas used for firing the boilers amounted to 250,000 cubic feet per twenty-four hours.

The pipe line is steel, with plain ends and Dresser couplings; the diameters varying according to circumstances. It is estimated that in the United States there are about 25,000 miles of natural gas pipe-lines in operation. Several of the cities and districts using the gas receive their supplies from wells as far as 200 miles distant. Even then the selling price to private consumers is never more than 35 cents (1s. 5½d.) per 1000 cubic feet; while for manufacturing purposes it may be as low as 10 cents (5d.). So that the cost of distribution, notwithstanding the length of the pipe-line and the pumping-stations required, must be very low.

The pressure at which the gas is distributed to the consumers is higher than is customary in this country for manufactured gas—being about 7 inches of water pressure. But practically every meter has a governor, which reduces the pressure to the normal 3 inches or thereabouts.

Consumption.

It is unnecessary to point out the benefits which a cheap supply of high calorific power gas confers on a community both for manufacturing and domestic use. It remains, therefore, only to emphasize this by stating that the average consumption per year for private consumers in the United States amounts to 150,000 cubic feet; while in the City of Medicine Hat in Canada it is 250,000 cubic feet. For commercial use, this gas, of a calorific power of 1100 B.Th.U. per cubic foot, is sold at 10 cents (5d.) per 1000 cubic feet, and competes with steam coal at $1·80 (7s. 6d.) per ton.

In conclusion, the writer begs to acknowledge the courtesy of Dr. A. C. Humphreys and his partner, Mr. Alten S. Miller, of New York, and the General Manager and staff of the Philadelphia Company of Pittsburgh, to whom he is indebted for much of the information he obtained.

STATUTORY GAS LEGISLATION AND MODERN REQUIREMENTS.

By Norton H. Humphrys, Assoc.M.Inst.C.E.

IV.

One often meets with the impression that the Gas-Works Clauses Act, 1847, was repealed, or, to all practical purposes, overridden by the later Act of 1871. But out of fifty sections, forty-five remain on the statute books to-day, and the general operations of a gas undertaking are more affected by it than any other enactment. The entire sections actually repealed are 14, 15, 17, 41, and 50; and two of these are inserted in the later Act. Section 14, as it stands, gives power to let on hire any meter and fittings for gas, on agreed terms; and sums due for hire are recoverable in the same way as those due for gas, and the meters and fittings are not subject to distress. If this had been allowed to stand, it would cover all that is required. But as it is, many magistrates' clerks rule that not only rent of stoves or fittings, but also meter rent, cannot be recovered by summary process, in the absence of any clause specifically giving such powers in a Special Act. Section 15 is repeated almost word for word in the 1871 (section 21) Act; and the same as regards section 17, which is repeated in section 22. The repeal of sections by the simple process of transferring to later Acts appears to the non-legal mind to be an unnecessary and a superfluous process. The remaining sections are unimportant; so it will be seen that practically the whole of the 1847 Act remains in force.

There appears no valid objection to section 14, which is already incorporated in several Special Acts; but it would seem that this and some other alterations have been made with a view to leaving material for Special Acts, or for giving opportunity for it to be contested. One unfortunate consequence of this is that some applicants for Special Acts have supposed, or have been advised, that the Model Acts practically cover everything, whereas it cannot be too strongly impressed upon all interested in the promotion of Bills that they are incomplete in many respects. This point is especially worth the consideration of small undertakings who decide to proceed by Provisional Order.

Sections 6 to 12 of the 1847 Act govern the important question of the right to lay mains and services, and the number of cases that have arisen under section 6, as quoted in "Michael and Will," affords standing evidence of the need for more definite pronouncement. At that time the use of roads was confined to gas, water, and sewerage; but now there are more like twenty different processes requiring conduits in the roads—such as hydraulic power, telephone, electricity, steam, separate storm water as distinct from the sewers, &c. The working under these sections is dependent on the good sense of the interested parties. In most cases, the local authorities recognize the desirability of encouraging local enterprise; but if for any reason the gas company are not in favour with the local authority, things can be made very unpleasant.

It should be clearly understood that the local authority do not confer any substantial consideration, in return for which direct or indirect payment, either in the form of rent or of special favoured nation clauses, can be expected, by granting permission to lay mains. That something of this nature exists, would appear to have been on the minds of those who drew up the Gas-Works Clauses Acts. The local authority incur no expense and take no risk, but pass on the whole expense, and responsibility for re-instatement, to the undertakers. The gas company are not strangers from a distance, who may be here to-day and gone to-morrow, but are permanently established in the district, large ratepayers, and employers of local labour. They ask no favour, but, on the other hand, should not be made to pay indirectly in such ways as being compelled to convert a part of an old road into a new one.

Section 9 is not at all clear as to whether the word "plan" refers to a detailed drawing to scale, or to a general description expressed in writing, but the general sense would indicate the second definition. A drawing cannot be "determined by two justices," or "proposed." Yet it is frequently contended that the local authority are entitled, before the road is broken up, to a complete drawing to scale, showing full particulars of depth, levels, location of pipe, &c.; and that this must be approved before the work can be done. Not only is it impossible to prepare an accurate forecast of the work, without opening up the whole of the area involved, and making a full preliminary inspection, but the right to "approve" a complete drawing carries with it a dangerous degree of power. A hostile authority can postpone the work, or put on such restrictions as to render it a practical impossibility. No objection can be taken to fair and reasonable arrangements for the protection of sewers, tunnels, bridges, subways, &c. But some protection is required against extortionate charges for rent or wayleave from private owners or railway companies, for such privileges as going over or under a bridge without coming in actual contact, or otherwise interfering, with it.

Section 13 of the 1847 Act, as it stands, is a useless superfluity, as there would be nothing to prevent the sale and supply of gas to private or public individuals by agreement, if it did not exist. But it is over-ridden by section 11 of the 1871 Act, in which the permissive word "may" is replaced by the imperative "shall." Incidentally, notice of the one-sidedness of this section has been previously made—viz., there is no protection against unremunerative outlay. The company incur the fixed and definite responsibility of laying and maintaining 30 feet of service-pipe; but all the consumer can be called upon to do is to consume, within two years, a quantity of gas represented by 40 per cent. on the cost of the 30 feet of pipe. This cost may possibly not exceed £1; and the consumer is only liable for 4s. a year for the first two years, and for nothing afterwards. This part of the section should be replaced by a reasonable minimum for each size of service, such minimum to afford a prospect of remunerative business.

We have remarked that the gas company possess no powers on the consumer's side of the meter. To some extent this is not literally correct, because section 21 of the 1871 Act gives power to the gas company to enter at reasonable times upon all premises lighted by gas, for the purposes of "inspecting" the meters, fittings, and works. It is desirable that the visit, in some cases, should extend to "unreasonable times." But suppose that the result of an inspection is to elicit that the meter is being overworked, or that gas is being used in some of the ways previously, indicated, to the discredit of the suppliers. There is no remedy other than the somewhat doubtful one afforded by section 19, under which parties "wastefully or improperly using gas" can be fined. This probably refers only to fraudulent use of gas, and at any rate is not an efficient means of preventing the use of twenty or more gas-lights on a ten-light meter, bad and leaky gas-fittings, improper burners, &c. The section requires to be completely reconstructed.

As with private consumers, the permissive "may" of section 13 of 1847 is replaced by the imperative "shall" in section 24 of 1871, which controls the supply of gas to public authorities. This section was not a fair one under the circumstances obtaining in

1871, when gas practically held the monopoly for public lighting. But the unjustness and one-sidedness are greatly aggravated by modern conditions. While the local authority incur no obligation whatever—not even the ridiculous one applied to private consumers—they can demand a supply of gas to be laid on to any lamp within 50 yards of any of the mains belonging to the gas company, and if so disposed need not light it once in six months. And it is the usual thing to bargain for further clauses of the favoured nation order, wherever application is made for a private Act. A by-street or lane can be efficiently lighted with a No. 2 Kern burner using 2¼ cubic feet per hour, or about 8500 cubic feet per annum on a 3800-hour schedule. In order to obtain this amount of business, the company may be called upon to incur an outlay of £6 or £7. At current prices, the actual income would be about 21s., and the net profit 4s. to 5s.—not sufficient to pay 5 per cent. on the outlay. It has been held that the words "supply gas" carry the whole cost of the material and labour required for the service-pipe.

The fundamental error lies in regarding the local authority as being in the same position as one large customer, who takes gas through one service and meter. But there is a great difference in the cost of supplying 10 million feet of gas to a railway company through one 6-inch main pipe and one 500-light meter, and of supplying the same quantity to 600 or 700 lamps through 600 or 700 different services, some extending to 50 yards in length. In the first case, there may be 100 yards of main on the inlet to the meter. In the second, there may be an aggregate of 7 to 8 miles run of service-pipe, which not only adds to the annual expenses in the distribution account, but should be fairly credited with its share of the unaccounted-for gas. A more accurate idea of the position would be gained by regarding the local authority as one customer owning as many meters as there are public lamps. More than this, the conditions of usage in the public lamps involve more risk of excessive consumption, or of more gas being used than is paid for, than obtain in the case of a private consumer. The sections relating to public lighting might be repealed to the advantage of all concerned. References to pressure regulators, or to average meter systems are now quite obsolete.

The reserved fund as authorized by section 31 (1847) is a fetish that has, on the whole, done companies more harm than good, and many who have in accordance with the law invested in Government security (presumably for the purpose of putting the money in a safer place than is afforded by the ordinary business), have reason to regret that they are not allowed to retain the money and use it as floating capital. When it is necessary to write-down Government securities to the extent of 10 or 20 per cent. (and one hears of banks being brought to ruination by the depreciation of such securities), one is tempted to ask where the advantage of investing in Government or other securities really comes in. The presumption is that such securities will afford the means of realizing full value at a short notice—say, three or six months. If a gas company is unfortunate enough to have to go into a Parliamentary Committee room or into one of the Law Courts, one of the arguments urged against it is sure to have reference to the reserve fund. They have not only paid full dividends, but have kept the reserve full, and have either never drawn on it or merely to a nominal extent. The £1000 or £2000 is an asset, whether it stands on deposit at the bank, is invested in Government or other securities, or is part of the working capital. Incidentally, as working capital it earns a larger return than can be obtained in any other way; and it seems a curious procedure to invest excess profits at 2½ per cent. and raise working capital at 5 or 6 per cent. It is difficult to see how £1000 invested is safer or more beneficial than £1000 in the business. The title "reserved fund" would lead one to suppose that if by reason of a natural catastrophe—such as an earthquake—the concern came to an end, the creditors could not touch the money in the fund, but that it could be distributed for the benefit of the shareholders. But as a matter of fact, it would have to go by the board just as any other asset. It is obviously necessary that there should be something in the way of a balance-wheel, to meet fluctuations in the cost of materials or special losses. There are many reasons against frequent variations in the price of gas. But this can be provided for just as well by an undivided balance of profit that is not earmarked in any way. The necessity for a draft on the reserve does not arise in a week or in a day, but can be foreseen and provided for months ahead. And this is the policy followed by many gas companies to-day, and, after recent experiences with Government securities, is likely to find increased favour.

The testing clauses, sections 28 to 34 (1871) are entirely useless, affording no protection to the consumer, and causing unnecessary expense to the company. There are hundreds of small undertakings throughout the country to-day fitted with a photometer room, fully equipped at a cost of £100 to £150, that is never used at all, or it may be that the manager takes a few tests when buying a different class of coal or trying some new system of working. Gas companies no doubt have their faults; but it cannot be said that, even before any competition worth the name existed, they were negligent in the matter of quality or purity. The few cases of bad or impure gas on record were due to inexperience and ignorance rather than to deliberate design. Invariably the natural respect for one's character and standing, has led to a general desire to supply a good, pure article. Many gas undertakings are promoted by, and in the interest of, the consumers; and in any case the users have what is known as a controlling interest. If any engineer was so ill-advised as to deliberately supply gas of inferior photometrical power, or containing sulphuretted hydrogen, he would hear about it at the next shareholders' meeting, if not before. With a maximum price and limited dividend, there is no financial advantage to be attained by devious ways. Added to this, the consumer cannot be imposed upon without knowing it; and he is no longer in any way dependent upon the gas company. If they do anything to deserve discredit, he can boycott them without inconvenience to himself. There is now no need for the testing clauses, and in many small and medium-sized towns, they have been a dead-letter for years.

MODERN PRACTICE IN FUEL CONTRACTS.*

THE subject matter contained in this book has some interest for those officials of gas undertakings who are responsible for the purchase of coals. The present system—or want of system—of buying coals by name and reputation is admittedly unsatisfactory. Many coals vary to a very great extent, according to the pit or seam from which the particular coal is won. Some coals are for this reason notoriously variable. This being so, it is not surprising that much loss and trouble are experienced at times when inferior qualities are supplied. The writer has frequently observed a 15 per cent. variation in quality of a coal, all of which is known by one name. This cannot be considered satisfactory either for purchaser or seller.

This book by Mr. Myles Brown deals with the present-day methods of contracting for fuel; a great many examples of approved specifications being reproduced in full detail. In the majority of cases, however, they deal with those in which the coal is required for steam-raising purposes; a comparatively few only treating of gas coal. In the case of the former, it is fairly common practice to specify the size, calorific value, content of ash, and moisture in the coal, which is also required to be fresh gotten and free from impurities—such as stones, dust, pyrites, dirt, bats, and shale. But in the case of the latter, few similar requirements are specified; and it is explained by the fact that the two cases are by no means analogous.

The author strongly advocates the use of analytical methods in the determination of the purchase price of fuel. With this expression of opinion, it is impossible to disagree. With gas coal, however, the question is not an easy one. In using steam coal, if we know the calorific value, the percentage of inert material, ash, and moisture, and the size, a very close idea may be formed of its value for practical purposes. With gas coal, on the other hand, apart from the ash and moisture contained in it, it is impossible to come to any really definite conclusion from the percentage of carbon and volatile matter shown to be present. The question of the quantity and quality of the gas and bye-products still remains to be proved by actual carbonizing operations. If, however, a sliding-scale based on the percentage of ash and moisture determined the definite price to be paid for each consignment of gas coal, much of the unsatisfactory nature of present purchase methods would be removed. The reviewer has digressed; but the subject calls for some comment.

The book under notice is largely a collection of typical specifications, analyses of various classes of coals, and details of other matter usually connected with the use of coal. It cannot be considered especially interesting to those connected with the gas industry. The author does not, in fact, attempt to express any opinions on the drawing-up of contract specifications. He contents himself by merely accumulating large quantities of data, and there leaves the matter for the reader to digest and summarize to the best of his ability.

* "Modern Practice in Fuel Contracts." By Myles Brown, M.E. Published by "The Science and Art of Mining." [4s.]

Next Year's Meeting of the Institution of Gas Engineers.—We are asked by the Secretary (Mr. Walter T. Dunn) to announce that next year's annual general meeting of the Institution, which is to be held in London under the presidency of Mr. R. G. Shadbolt, of Grantham, will open on Tuesday, the 11th of June.

Hazell's Annual for 1912.—We have received from the publishers, Messrs. Hazell, Watson, and Viney, Limited, a copy of the above-named work, which has reached its twenty-seventh year of issue. The events of the current year have rendered necessary the introduction of an exceptionally large number of new articles. Those in which our readers are interested relate to home affairs; and they will find the question of labour unrest has received attention. An exhaustive summary of the Insurance Bill is given; and the most important of the amendments introduced in the days immediately preceding the publication of the "Annual" are noted in the coloured pages of "Occurrences during Printing." At the request of many correspondents, room has been found for a review of the books of 1911; and among other novelties is a "Diary of Events." The index has been again enlarged, and contains about 7000 references. The book has been edited by Mr. Hammond Hall; and the contents have been revised up to the 25th ult. From a glance at these, the "Annual" appears to justify its claim to be "the one book of reference for everyone."

WATER AFFAIRS.

Review of the Principal Events of the Year.

In accordance with custom at this season, we review the principal events in connection with the supply of water which have been recorded in the "Journal" during the past twelve months.

Summer Heat and Drought and Autumn Rain.

The outstanding feature in the history of water supply in the year now drawing to a close is undoubtedly the abnormally hot and dry summer. On the 7th of July, the thermometer registered 85° in the shade and 123° in the sun; and by the 22nd of the month the figures had gone up to 90° and 132°. For twenty-three days from the beginning of July, the temperature was 80° and upwards. On the 9th of August, the extraordinary shade reading of 100° was recorded at Greenwich. On the 28th of July, London was visited by a remarkable thunderstorm about five o'clock in the afternoon. With the sun shining, there came quite suddenly vivid lightning and heavy thunder, accompanied by driving wind, large hailstones, and torrents of rain—an inch falling in fifteen minutes. So great was the force of the wind, that branches of trees were broken off and a heavy vehicle was overturned. With this exception, there had been a long continuance of dry weather. It began in the early part of June; and at the beginning of July the drought was at its worst—many places having been without rain for periods ranging from 24 to 26 days. In the closing week of July, thunder showers of varying weight occurred. But, though they were fairly general, they were not universal; and in some localities the rainfall was too slight to have any real effect upon the heated soil. After the severe storm of the 28th just referred to, there was again a long period of rainless weather, accompanied by the abnormally high temperatures already mentioned. On the 19th of August, however, London was visited by a thunderstorm just before six o'clock; and by the 22nd the drought had broken.

It may be interesting to reproduce here some figures in regard to periods of drought communicated to "The Times" by probably the greatest authority on rainfall, Dr. Hugh Robert Mill. He pointed out that in the 52 years from 1859 to 1910 there had been only three in which there had been three absolute droughts—viz., 1868, 1887, and 1899. To these, however, the present year must be added. In 1868, the dry periods were 15, 17, and 21 days, or a total of 53 days; in 1887, they were 15, 25, and 17 days, or a total of 57 days; in 1899, they were 16, 24, and 19 days, or a total of 59 days; and in the present year, 15, 24, and 17 days, or a total of 56 days. Out of the four years taken, it will be seen that there were two in which the dry weather was of longer duration than in 1911. It is worthy of note that the third period of drought in 1899 was from Nov. 12 to Nov. 30.

The question naturally arises whether the occurrence of so many absolute droughts means that the year as a whole will have been one of deficient rainfall. The average fall for fifty years, as recorded at the observation station in Camden Square with which Dr. Mill has for so long been associated, is 25·14 inches, with 162 rainy days; and the figures for the three years having three drought periods were 23·4 inches and 142 days in 1868, 19·21 inches and 140 days in 1887, and 22·54 inches and 144 days in 1899. Until the figures are available, it is uncertain as to whether the present year will prove to have been a dry one. At all events, Dr. Mill considers we may congratulate ourselves on having had a summer which, "for warm serenity of weather, cloudless skies, and continuous sunshine, can only be compared in the last half-century with 1868 and 1887, and will be found to have been the warmest and brightest of them all." But, as tested by the amount of evaporation from a freely exposed water surface, the period from July to September was drier than in any year since records of evaporation were started in 1885. Copious autumnal rains have, however, done much to bring the average to something near the normal. The week-end period from Nov. 18 to 20 was the wettest experienced during the whole year. At Worthing there was a fall of 2·27 inches of rain; and the weather conditions in London, the Midlands, and the East of England were dreary in the extreme, with no sun and continuous rain for some forty-eight hours. Wide stretches of land along the Medway Valley were right under water; and the river rose some 12 feet above its normal level. Sunday, the 10th inst., will be remembered as a day of incessant wind and rain; and early last week the Swansea Valley was flooded for nearly twenty miles.

It is scarcely necessary to say that the long continuance of dry weather in the summer severely taxed the resources of water undertakings all over the country. The supply had to be curtailed in Manchester and other places; and stringent injunctions were issued against lavish use and waste of water. Bradford suffered very seriously from the restrictions which had to be imposed; and work had to stop in consequence. Even as late as the 25th of October, some of the Sheffield reservoirs were quite empty; and there were less than 2000 million gallons of water in stock, compared with nearly 4500 million gallons at the corresponding time last year. Curiously enough, Ireland, which is certainly not generally regarded as a dry place, had the unusual experience of a shortage of water. Dublin was threatened with a water famine; Belfast was in very much the same condition; while in Londonderry the water supply to manufacturers was stopped, and only a limited quantity of it was available for drinking purposes. On the 18th of October, there was only sufficient water in the Dublin reservoirs for nineteen days' consumption. Fortunately, heavy rain came to the general relief towards the close of the month. It was stated in Dublin, however, that it would take about a month of wet days to fill the Roundwood reservoir; while in Belfast it was announced that, owing to the heavy drain on the storage during the preceding three or four months, economy would have to be exercised during the whole of the winter.

London, happily, passed through the trying period without any interruption of the constant supply of water to which the inhabitants have for some years been accustomed. At the first meeting of the Metropolitan Water Board after the summer recess, a statement submitted by the Engineer showed that the total number of complaints received as the result of insufficiency of pressure during the three months from June to August was 374, or an average of 125 per month. This was equal to one complaint per month for every 57,004 persons served. The week of maximum demand in 1910 was that ended June 24, when the supply per head per day was 37 gallons. Last summer this quantity was exceeded on no fewer than twelve occasions. The week of maximum demand was that ended July 28, when the supply per head per day was 42·1 gallons. The Chairman (Mr. E. B. Barnard) remarked that, after what had been happening in towns all over the country, it was a matter for enormous satisfaction that London could claim that, whereas in the previous three months she had had a supply of more than 300 million gallons of water in one day to upwards of 7 million people, the constant service had never been withheld. The Board, in a formal resolution, expressed their thanks to the Deputy Chief Engineer (Mr. J. W. Restler, M.Inst.C.E.) and the whole of the staff of the engineering department, for the manner in which the supply of water to the consumers throughout the Board's area had been maintained during the drought; and the members were invited to direct the special attention of their respective authorities to the matter. It was an achievement of which the Board had good reason to be proud; but, as Sir Melvill Beachcroft pointed out, they were assisted in its accomplishment by the Intercommunication Act of 1899. The President of the Local Government Board (the Right Hon. John Burns), in the course of a letter in which he congratulated the Board on the success of their administration of the water supply during the summer, also referred to the benefit which had accrued to London "from the linking-up of reservoirs which were formerly detached and isolated." It is only justice to the Board's predecessors to mention that it was partly due to their action that the measure which has since been found so beneficial was placed upon the Statute Book. Viscount Llandaff's Commission of 1897 presented a special report in favour of an intercommunication scheme; and the Water Companies introduced a Bill for the session of 1899. The Government, however, took up the matter; and the Metropolis Water Act, 1899, was the result. Acknowledgment should also be made of the assistance rendered to the Board by the Thames Conservancy, through the timely action of the Chairman (Lord Desborough), in their very difficult task of supplying London with water during the exceptional drought. As reference has been made to the intercommunication scheme, it may be mentioned that only a few weeks ago the Board obtained permission from the London County Council to extend it by laying a 20-inch

pipe through Woolwich Tunnel so as to connect the supples north and south of the Thames.

Position and Work of the Metropolitan Water Board.

Passing now to a review of the events of the year, we will, as on previous occasions, commence with the Metropolis, and glance at the work of the Water Board. At the first meeting after the Christmas recess, the Works and Stores Committee presented a special report on the subject of the abstraction of water from the Thames, and the proposed settlement of the dispute which had arisen in regard thereto between the Board and the Conservators of the river. It was stated that certain specified conditions of abstraction had been agreed upon, with the result that litigation which had been commenced between the two bodies would be abandoned. It was decided to take the necessary steps to obtain parliamentary confirmation of the settlement. This however, was found to be a by no means easy task. The Board's great scheme for the construction of storage reservoirs in the neighbourhood of the Thames encountered so much opposition, that their proposals in regard to the river seemed to be in jeopardy. At a conference between the Board and representatives of local authorities affected by the scheme, held early in the year, certain concessions were made; but they were not considered altogether satisfactory. Eventually the Board's New Works Bill and the Thames Conservancy Bill embodying the agreement above alluded to were referred to a Joint Committee of the two Houses, under the presidency of the Earl of Kintore. Their deliberations extended over a long period, in consequence of the large number of parties opposing the Board. In the result, the scheme, which originally provided for the construction of eight reservoirs, calculated to supply water to London till 1941, was so curtailed that the Board at first decided to withdraw what was left of it, and go to Parliament again at some future time. Subsequently, however, they reluctantly agreed to accept the conditions imposed by the Committee; and the Bill, as well as that of the Thames Conservancy, was passed. As the provisions of both Acts have been only recently noticed [*ante*, pp. 527, 528], it is unnecessary to refer to them again here.

Though unsuccessful in obtaining parliamentary sanction for works which they considered necessary to ensure the future water supply of London, the Board have been able during the year to show the public that they are keenly alive to the advisability of completing those for which their predecessors had obtained authority. Early in June, the new pumping-station at Walton, commenced in October, 1908, was formally opened by the President of the Local Government Board (the Right Hon. John Burns), in the presence of a numerous company. The station had been constructed under powers granted to the Southwark and Vauxhall Water Company by their Act of 1898, and transferred to the Board by the Metropolis Water Act of 1902. The works were designed by Mr. J. W. Restler, M.Inst.C.E., the Engineer to the Company, and now Deputy Chief Engineer to the Board; and the four very fine engines, the first of which was started by Mr. Burns, were greatly admired. Early last month, the large reservoir which had been constructed at East Molesey, was opened by the outgoing Lord Mayor (the Right Hon. Sir T. Vezey Strong), in the presence of a large gathering, which included the Lord Mayors of Dublin and Cardiff, the Mayors of several of the Metropolitan Boroughs, and representatives of Metropolitan and Provincial municipalities. The reservoir was named the "Island Barn;" it having been constructed on a site upon which a barn formerly stood. The land was acquired by the Lambeth Water Company under the provisions of their Act of 1900, which also authorized the construction of the reservoir; but the powers were not exercised. In 1907, however, the Board, by their Various Powers Act of that year, obtained parliamentary sanction for the building of the reservoir, subject to certain modifications in extent and design; and they immediately took steps to secure the completion of the work, in order to keep pace with the growing necessity for additional storage. The work was commenced on Oct. 24, 1908, when the then Chairman of the Works and Stores Committee (Mr. Charles E. Hearson) performed, in the presence of the President of the Local Government Board, the ceremony of cutting the first turf.

These two important events in the history of the Board must not be left without reference to the conspicuous interest taken in them by Mr. Burns. It was at his suggestion that the "Island Barn" reservoir was commenced at a rather earlier date than was intended, with the view of providing work for the unemployed. As already stated, he was present at the starting of the work, and made an encouraging speech. Though he was unable to witness its completion, he sent to the Chairman of the Board a letter in which he expressed his appreciation of their excellent administration of the great undertaking in their hands, which had enabled them to furnish a constant supply of water to the inhabitants of the Metropolis all through the long-continued drought which had taxed the resources of so many suppliers of water in various parts of the country. Nor must omission be made of testimony borne by a much higher personage than Mr. Burns to the value of the Board's work. On the return of the King and Queen after their visit to the City on the 29th of June, in connection with the Coronation festivities, a halt was made at the New River Head, in Rosebery Avenue, Clerkenwell, to admit of the presentation of an address from the Board. This was done by the Chairman (Mr. E. B. Barnard); and in reply His Majesty said he was well aware of the extreme importance of the duties entrusted to the Board, and of the difficulties which had been successfully surmounted in ensuring to the population of London a continuance of the "pure and abundant water supply" upon which the health of the Metropolis largely depends. "Dwellers in London," said His Majesty, "are perhaps too ready to accept this great boon as a matter of course; and it is well that we should have an opportunity of acknowledging the great debt we all owe to you and to your predecessors, and, above all, to Sir Hugh Myddelton, for the enterprise and energy which have contributed to make the water supply of London the finest in the world." Whether or not it can claim to occupy this very high position, the reports of the Board's Director of Water Examination (Dr. A. C. Houston) testify that the quality of London water is irreproachable; while the monthly returns made by the officials show that the quantity supplied per head of the population is by no means inadequate to their requirements.

This is all very satisfactory; but there is another side to the picture. The Board's financial position is a matter which causes some anxiety; and their relations with some of the consumers cannot, judging by the litigation in which they are from time to time engaged, be characterized as very cordial. The Charges Act of 1907, while relieving some, put burdens on others, with the result that private supplies have replaced those of the Board. At a meeting of the Board held in March, the Chairman stated that the passing of the Act left them worse off by £28,000 a year; and the sinking of private wells had entailed a further loss of £20,000. This made approximately £50,000 a year loss through the Act. When the Budget statement was made in June, the deficiency for the year 1909-10, which was expected to be about £61,000, compared with an estimate of £75,000, proved to be only £46,000; and the deficiency for the year 1910-11 would, it was thought, amount to £56,000, compared with £85,000 estimated. Looking forward, the Chairman of the Finance Committee (Mr. A. H. Tozer) could only give the very small sum of £2915 as the increased rental for 1911-12, which he characterized as "extremely disappointing," especially in a year immediately following a quinquennial valuation of the Metropolis. Indeed, this had adversely affected the water-rental for the current year, for which, as stated, they were faced with an estimated deficiency of about £85,000; and they could only hope that, as in former years, the actual result of the twelve months' working would show some improvement on this figure. Mr. Tozer considered the position of the Board was like that of a commercial firm which was over-capitalized. They were trying to pay dividends out of income which was insufficient to meet their requirements owing to the action of Parliament, for which the Board were not responsible. In his judgment, it would be some years before they could hope for an improvement.

The Board's Litigation.

Having glanced at the financial position of the Board, let us see how they stand with the consumers. At the outset it must be acknowledged that the relations do not appear to be so cordial as might be wished. At the same time, it must be pointed out that the Board try, wherever possible, to settle amicably any difficulty that may arise. In so vast an undertaking, however, there must necessarily be questions which have to go before the Courts, in order that the Board may not be deprived of the rights which have been conferred upon them by Parliament. An outstanding

instance of this occurred in Colley's Patents case, which the House of Lords have lately decided in the Board's favour. The case is of sufficient importance to be epitomized. The question turned on the charge to be made for the supply of water to a factory. The Board commenced an action in the County Court to recover £21 4s.; this being 5 per cent. on the rateable value of the premises for a domestic supply. The defendants disputed their liability for the amount; but they paid into Court £8 4s., which they admitted to be due for a supply of water for the purposes of their trade or business, under certain sections of the Board's Charges Act. In the County Court, his Honour Judge Woodfall decided in their favour. On the matter coming before the Divisional Court, the Judges differed as to the use of the water; and, in accordance with the rule, the appeal was dismissed. The Board then went to the Court of Appeal, where their contention was sustained by two out of the three Judges who heard the arguments. Thereupon the factory owners, considering the case of sufficient general importance to justify an appeal to the House of Lords, asked, through the Press, for financial assistance to enable them to prosecute it. The result was, as already stated, a decision in favour of the Board; and, fortunately, their Lordships were unanimous. Here was a case in which a small sum of £13 was in dispute, and it required ten Judges "learned in the law" to interpret the Act of Parliament under which it had been imposed, and three of them differed from the rest. But though the amount was small, the principle involved was a great one; and the Board were justified in the steps they took to have a definite pronouncement upon the meaning of their Act. The pity is that the drafting of the particular section —the language of which was characterized by the Lord Chancellor as "barbarous and slovenly"—should have been so faulty as to cause so much ambiguity.

In addition to the case just noticed, the Board were in the Courts in respect of liability for stopcock box accidents. In October, 1910, Mrs. Florence Batt brought an action to recover damages in respect of the defendants' alleged negligence in not keeping in repair a stopcock box on the highway of Amery Place, Old Kent Road. The Board contended that they were protected by the Metropolis Water Act of 1871 or else by their own Act of 1907. The County Court Judge decided against the plaintiff, on the ground that the Board were not liable to keep the box in order. The lady appealed to a Divisional Court; and the appeal was allowed, with costs. The Board then took the case to the Court of Appeal, and were successful; their Lordships deciding that there was a statutory obligation upon the owner or occupier of the premises with which the stopcock was connected to keep the box in repair. A pedestrian in the Laleham Road, Catford, tripped over a stopcock box, the corner of the lid of which was broken off; and he brought an action, in the Greenwich County Court, against the Board and Mr. W. E. Howell, the landlord of the house outside of which the box was fixed, to recover £10 damages for an injury to his knee. There was no evidence that the Board's employees broke the box; and his Honour dismissed that authority from the action. Mr. Howell, however, was ordered to pay the plaintiff the amount claimed, with costs, and also those of the other defendants. The Board were less fortunate in an action for damages arising out of a trap accident caused by a hole made in a roadway in connection with repairs. It was stated that the hole had been properly filled in, but that the stones and earth had been displaced by children, who often caused a great deal of trouble in this way. Judge Woodfall, however, before whom the case came, at the Westminster County Court, decided in favour of the plaintiff, for £12 and costs.

In October, 1910, the Board were defendants in an action brought against them for cutting off the water supply to certain premises at Hoxton, with the result that they were unlet, and the owner (the plaintiff) sustained a loss. It was argued that at the time the water was cut off the premises were empty, and that they (the Board) were not bound to go on supplying till the place was relet. The Magistrate (Mr. Cluer) fined the Board £3 12s. and £15 15s. costs. But he thought they had a clear right of action against the complainant; and he agreed to state a case. This came before the Lord Chief Justice, Mr. Justice Ridley, and Mr. Justice Channell, who dismissed the appeal, with costs. The Lord Chief Justice said he was of opinion, on the facts found by the Magistrate, that the Board had not the right to cut off the water; and the other Judges concurred. An attempt was made to render the Board liable for damage caused by an escape of water from a defective disused pipe into the basement of premises in Piccadilly. The case occupied his Honour Judge Woodfall for two days; but as no evidence of negligence on the part of the Board was adduced, he non-suited the plaintiffs (the Piccadilly Arcade Gallery, Limited), with costs.

A case of considerable public importance came before his Honour Judge Parry, at the Lambeth County Court. The Electric Palaces, Limited, of Atlantic Road, Brixton, sued the Board for the recovery of £31 in respect of overpaid water-rate. The defence put forward was that, by virtue of the Public Authorities Protection Act, the Board were not liable to have claims brought against them after the lapse of a period of six months. His Honour commented in rather strong language on the action of the Board, and held that the Act calculated the date from which the six months' limitation should apply from the time the money was paid; and, as the claim was made within six months after payment, the Board should return the money. The matter was subsequently taken up by a member of the Board, who called a conference of representatives of local authorities to consider the position; and a resolution was passed expressing dissatisfaction with the action of the Board.

Early in the year, the final stage was reached in the litigation between Sir Frederick Adair and the Board and the New River Company in respect of the liability for the payment of the sum of £400 per annum known as the "King's Clogg." The matter came in the first instance before Mr. Justice Warrington, who decided that the Board were liable. The case was then taken to the Court of Appeal, where this decision was upheld by the Master of the Rolls and Lord Justice Farwell; Lord Justice Fletcher Moulton being of the contrary opinion. On appeal to the House of Lords, where the case was twice argued, the decision of the majority of the learned Judges in the Court below was unanimously upheld without the respondent's Counsel being called upon. The Lord Chancellor remarked that there could be no doubt as to the efficacy of the original charge on the King's moiety of the New River Company's undertaking; and this was sufficient to show that the judgment of the Court of Appeal ought to be affirmed.

Schemes of Improved Water Supply.

Apart from the two additions to the water-works of the Metropolis to which reference has already been made, there have been but few water schemes of any magnitude calling for notice in our columns during the year. Taking the completed schemes first, the improved water supply provided for Lincoln claims attention. Readers may remember that the city had been for several years in great trouble in regard to the water supply. Some of the sources were liable to pollution, and an epidemic of typhoid fever led to their abandonment. Misfortune attended the Corporation in their attempt to obtain water by boring; and eventually, on the recommendation of their Water Engineer (Mr. N. M'Kechnie Barron), they undertook an entirely new scheme for the supply of the city from Elkesley, in Nottinghamshire. The collecting works are situated 22 miles from Lincoln; and they were designed for a maximum of 3 million gallons a day for the city, and 600,000 gallons for certain villages which have to be supplied under provisions of the Act sanctioning the scheme. The inauguration of the new supply on the 4th of October was regarded as a turning-point in the history of the city, and the closing of an unpleasant episode. The ceremonies commenced with a service in the Cathedral, which was attended by the Mayor and members of the Corporation in state, and at which the Bishop gave an address. It was in every respect a day of public rejoicing—bells ringing and people cheering.

The other works completed during the year may be briefly noticed in alphabetical order. At Barnyards of Delgaty, a new reservoir, constructed at a cost of about £4500, was opened. New water-works for Bedale and the village of Aiskew were brought into use early in the year. New pressure filters were provided at Fern's Park and at Sweetloves, in connection with the water-works of the Bolton Corporation. A pumping-station at Waddon, erected at a cost, with the plant, of £30,000, was added to the water-works of the Croydon Corporation. The works of the Devonport Corporation were enlarged by a new reservoir capable of containing 21 million gallons, which brought up the total storage capacity to 45 millions. The new Carno works of the Ebbw Vale Urban District Council, commenced in the spring of 1905, were opened early in October.

Water-works for the supply of Grangemouth and the central district of Stirlingshire, which had been under construction for nearly six years, were formally inaugurated in the summer. A few weeks ago, new works were opened for the supply of Innellan, in extension of those which have for many years supplied the town. Instow has been provided with a supply of water by the Barnstaple Water Company, under an agreement with the Rural District Council. Early in the year, water-works were finished for Maryport, at a cost of £15,000; and a scheme for supplying Newbiggin-by-the-Sea by the Tynemouth Corporation, at a cost of £6300, was inaugurated. New water-works for Shanklin were opened in September; and a few days previously, the water-supply system of the Swansea Corporation was completed by the opening of the Morriston service reservoirs, which had cost £20,000. The Warrington Water-Works were extended at an outlay of £17,709; and those of the Corporation of Wolverhampton by the construction of an engine-house and a reservoir at Tettenhall.

Of the works commenced or projected during the year, first in importance stands the scheme of the Birkenhead Corporation for bringing a supply of water for the borough from North Wales. Early in October, the foundation stone of the works was laid by the Chairman of the Corporation Water Committee (Alderman Bloor). They will furnish a supply of water by gravitation from the River Alwen. The reservoir will contain 3000 million gallons; and the aqueduct conveying the water to Birkenhead will be 42 miles long. At present, only the masonry dam of the reservoir has been put in hand; the contract amounting to £186,153. Towards the end of the summer, indications were given of the intention of the Fylde Water Board to undertake a large scheme of water supply at an estimated cost of £2,000,000; and a definite move has been made by the publication of the usual statutory notice of an application to Parliament next session for the necessary powers. It may be incidentally mentioned that this is the Jubilee year of the undertaking. Quite early in the year, tenders were let for the construction of works for which the Exmouth District Council obtained powers in the session of 1910. At the close of May, a commencement was made with a new water-works scheme for Tidsbury and the district. A few weeks later, a large party journeyed from Cardiff to Llwyn-On, to witness the laying of the key-stone of the first masonry work in connection with a reservoir embankment to be constructed by the Cardiff Corporation. It is the largest of the three reservoirs sanctioned by their Act of 1886; and it will have a capacity of upwards of 1200 million gallons, and more than double the present storage. The Burnley Corporation have made a commencement with a large reservoir at Hurstwood, which will have a capacity of 320 million gallons, and cost, when completed, about £250,000. Contracts have been let by the Liverpool Corporation for the construction of a reservoir on the Vyrnwy aqueduct, near Malpas, Cheshire; and for the erection of an aqueduct station at Hatchmere. The reservoir will have a capacity of 4¼ million gallons.

Other schemes of smaller dimensions have been commenced or projected for Bideford, Camelford, Carlisle, Chiddingfold, Coventry, Cowes and other places in the Isle of Wight, Hartley Wintney, Ivybridge, Merthyr, Neath, Northallerton, Petersfield, Portrush, Southampton, Topsham, and Wigton. Outside our own country, St. Petersburg is taking active steps to improve her water supply by the ozone process; and the whole question of a filtered river-water scheme is settled for Seville. As public interest has lately been attracted to India, reference may be made here to the completion at Calcutta early in the year (three months within the specified time) of the largest elevated reservoir in the world. It is a steel tank 321 feet square and 16 feet deep, supported by steel stanchions; the height from the ground level to the top being 110 feet. It will hold 9 million gallons of water, equal to a weight of 40,000 tons. It was constructed for the Calcutta Municipality by Clayton, Son, and Co., who were heartily congratulated on the successful completion of their contract.

During the year, the Local Government Board have either sanctioned loans or held inquiries in respect of them for the following places: Ash, Bakewell, Bocking, Braintree, Bridlington, Desborough, Diss, Fareham, Fulwood, Harrogate, Nantwich, North Wootton, Perranporth, Portland, Redruth, Skegness, South Molton, Torquay, Weston-super-Mare, and Wollaston.

Several proposals for the transfer of water undertakings have arisen during the year; and one of which the preliminaries were settled in 1910 was carried into effect. Quite early in January, the Pontypridd and Rhondda Joint Water Board acquired the undertaking of the Pontypridd Water Company at the cost of about £300,000; the Board taking over debenture stock to the value of £42,000. An offer was made by Mr. W. H. Lever, the owner of the Lymm Estate, to sell to the Lymm Urban District Council for £27,000 the water-works forming part of the purchase. A poll was taken on the question of the purchase of the undertaking of the South Hants Water Company by the Southampton Corporation; and the proposal was rejected by a majority of 2086. Conferences took place between certain local authorities to consider the advisability of a joint purchase of the undertaking of the Staffordshire Potteries Water Company. The subject was discussed at considerable length in the Stoke-upon-Trent (Potteries) Federated Council; but a decision was deferred pending the presentation of a scheme by the Water Committee. On the recommendation of the Water Committee of the York Corporation, it has been decided to apply for authority to acquire the undertaking of the York Water Company.

Water Legislation.

The water legislation of the year has been so recently noticed, that only brief reference to it is necessary here. Taking the companies first, the Chester Water Company obtained confirmation for the construction of their existing works, and authority for carrying out new ones, raising £75,000 of additional capital, and consolidating and converting that which has been already raised. The Ely Rural District Water Company was incorporated, with a capital of £30,000, for the purpose of constructing works and supplying water within a specified area in the rural district of Ely. The Felixstowe and Walton Water Company were authorized to construct additional works, and raise capital to an amount not exceeding £42,000, including premiums. Their Act contained a clause enabling the Urban District Council to acquire the undertaking; and application is to be made by the Council next session for the necessary powers. The Luton Water Company obtained authority to acquire additional land by agreement and to raise £100,000 more capital. The West Cheshire Water Company received legislative sanction for their existing works, and permission to raise more capital to the amount of £47,500, including premiums. The construction of the existing works of the Wirral Water Company was confirmed; and the Company were authorized to raise £5000 of capital, inclusive of premiums. The two Acts of the greatest importance in this group are those of the Chester and Felixstowe Companies. Stringent measures are imposed upon the former Company in regard to drawing water from the Dee; and the latter are faced with the prospect of parting with their undertaking.

Turning to the Acts obtained by local authorities, those of the Metropolitan Water Board and the Thames Conservancy occupy the principal places in the group. Their scope has already been indicated. The Blackburn Corporation obtained sanction and confirmation for the construction of certain works, authority to make others, and permission to raise £75,500 more money. The Chesterfield Gas and Water Board were authorized to carry out a number of works, comprising reservoirs and pipe-lines, and raise £155,500 for the purpose. The Corporation of London had conferred upon them further powers with respect to the control and repair of streets; and the Gloucester and Halifax Corporations were authorized to construct additional works. An extension of time was granted to the Corporation of Harrogate for the completion of a reservoir authorized by their Act of 1901; and the Hastings Corporation obtained an Act conferring upon them further power with respect to the water supply of the borough, and authorizing the construction of additional works and the purchase of the lands upon which the existing works have been built. As the result of the passing of a General Powers Act, the Hornsea Urban District Council are able to make better provision in regard to the supply of water. Authority was given to the Ipswich Corporation to erect a pumping-station; to the Kingston-upon-Hull Corporation to make water-works and extend their limits of supply; and to the Corporation of Merthyr Tydfil to construct an impounding reservoir in the county of Brecknock. The Oystermouth Urban District Council were empowered to purchase the undertaking of the Oystermouth and District Water Company; the Paignton District Council, to con-

struct filter-houses, filters, and other works; the Rhondda District Council obtained an extension of time for carrying out certain new works; and the Rotherham Corporation, permission to construct a service reservoir. The Slough Urban District Council were successful in their application for authority to acquire the undertaking of the Slough Water Company; the St. Helens Corporation may now ask for security for the supply of water; and the Swinton Urban District Council may maintain their existing works and construct others.

The Provisional Orders applied for were to obtain confirmation for existing works, and authority to construct others, extend limits of supply, and raise additional capital; and the results of the applications were recorded on the 21st ult. in the "JOURNAL." Bills to confirm the Orders received the Royal Assent on Aug. 18.

Three public measures bearing upon water supply were introduced during the session, but two of them did not reach the second reading stage. One was by Mr. Leif Jones, the Member for Rushcliffe (Notts.), to amend a defect which has been found to exist with regard to the taking of water by local authorities otherwise than by agreement. It was generally believed that, under the Public Health Act, 1875, Provisional Orders could be obtained by which water rights could be compulsorily acquired. But this was found not to be the case; and a Select Committee recommended that, with the view of affording all local authorities facilities for acquiring the right to take water from any stream, the Local Government Board should be empowered to issue Provisional Orders which, on confirmation by Parliament, would confer authority for the purpose. They thought, however, the Order should incorporate the Water-Works Clauses Act, 1847, in the same manner as is usual in a Private Bill; and that, prior to the issue of the Order, the statutory notices should in all cases be published and served by the local authority. The Bill introduced by Mr. Leif Jones was to carry out the recommendations of the Committee. The other Bill was introduced by Mr. Herbert Lewis, on behalf of the Local Government Board. Its object was to enable the Board, by Provisional Order, to give powers to local authorities for the purpose of the acquisition of water. It stipulated that provision should be made for compensation being given in respect of the abstraction of water under the Order. The compensation was to be given, if practicable, by means of the supply of a flow of water; but, if not, in such a manner, either by means of a payment of money or otherwise, as the Order might direct. This Bill was withdrawn on the 4th inst.; and the other was dropped at the close of the session on the 16th. The third Bill was the Government measure relating to national insurance; and, after much discussion, it passed. Section 62 contains a provision making suppliers of water liable for payments in cases of excessive sickness arising through insufficient or contaminated water supply, unless they can prove that it was not due to any default on their part.

LEGAL PROCEEDINGS.

The general legal business in connection with the supply of water has not presented many particularly striking features; but the cases which have arisen call for notice in reviewing the events of the year.

The well-worn question of the supply of water to workhouses engaged the attention of Mr. Justice Eve in the Chancery Division of the High Court of Justice, in an action brought by the Bristol Guardians to obtain a declaration that, under the Bristol Water-Works Act, 1862, their workhouses and buildings in the parish of Bristol are entitled to a supply of water for domestic purposes at the rates prescribed in the Act. The defendants said that none of the premises in question were "dwelling-houses" within the meaning of the Act; and also that, as in April, 1905, the Guardians agreed with them to pay for the water at the price of 1s. per 1000 gallons, this agreement was still binding upon them. It appeared, however, that the agreement had not been sealed. Plaintiffs claimed that they were entitled to a supply of water for domestic purposes calculated at a percentage, on scales named in the Act, on the annual gross rateable value of the premises. His Lordship said the dispute turned upon the provisions of the defendants' Act that water was to be supplied at certain rates to the "owners or occupiers of private dwelling-houses;" and the conclusion he had come to was that it would be impossible to hold that an institution such as one of those in question was what would answer generally to the expression "private dwelling-house." He therefore decided that the plaintiffs had failed; and he dismissed the action, with costs. The Guardians are, however, still of opinion that they are right, and have given instructions to their Clerk to enter an appeal.

At the Windsor County Court, his Honour Judge Howland Roberts was engaged for two days in hearing a case in which the Slough Water Company claimed some £47 from the Urban District Council in respect of the fracture of a water-main in the Slough Road on Aug. 30, 1910. There was a counterclaim by the Council for £29, for work done as the result of the leakage and the inconvenience caused by it. The first point to be decided was whether or not the Council had been guilty of negligence as long ago as 1902-3, when the trench containing the pipe was excavated and filled in. If they were, the question arose as to whether their neglect was really the cause of the damage discovered in August, 1910. His Honour came to the conclusion that both propositions had been reasonably established. He thought the plaintiffs had proved that the trench was not sufficiently rammed at the spot where the damage was done, and that the fracture was the result of the negligence. This being so, his decision must, he said, be for the plaintiffs. As, before the case went into Court, the parties had agreed that the damages should be assessed at ten guineas, he gave judgment for this amount.

At the Lambeth Police Court, Mr. Baggallay dealt with a summons taken out on behalf of the Southwark Borough Council against the owner of a house at Walworth for failing to provide a proper and sufficient supply of water to the upper part of the premises; but as none of the tenants appeared to complain, the summons was dismissed. A very similar case came before the Magistrate at Tower Bridge Police Court. The person summoned tried to put responsibility on the quarterly tenant of the premises; but his Worship would not allow this. An undertaking was then given that the work would be done within fourteen days. Another case of the kind was dealt with by the Magistrate at the Old Street Police Court, on a summons taken out against the owner of a number of tenement houses in Hoxton. Evidence was given that there was only one water supply for the whole house in each of the cases mentioned, and that this was in a back yard. Penalties of 20s., and costs, were imposed in all instances.

One of the customers of the Wokingham Water Company built stables on a plot of land upon which he subsequently erected a cottage. The stables were formerly assessed separately from the house; but the rating authorities had, for convenience, assessed both together, and the Company had increased their charges. Though the water was used for the house only, the Magistrate at the Wokingham Police Court decided that they had power to charge for a supply to the entire property. The question of the use of domestic water for trade purposes came before the Magistrate at the Portsmouth Police Court. The owner of a motor garage was summoned by the Portsmouth Water Company for this offence. The point raised was whether the Company had any authority to insist upon a supply by meter for trade purposes. His Worship decided that they had; and he imposed a fine of £2 and costs. The same Company charged a laundry proprietor with stealing, for use in his business, water supplied by them for domestic purposes. He pleaded guilty, and offered to pay for the water and the Company's expenses. The Bench imposed a £3 fine, and expressed a hope that the case would act as a deterrent to others who might be committing a similar offence.

The Aldershot Gas and Water Company were plaintiffs in two actions brought against consumers for using water unlawfully. In the first, the owner of a house who paid for a supply of water for domestic purposes only was found to be using it for keeping a fish-tank in good condition; and he was fined 10s., with 11s. costs. In the other case, the Company found that, about ten o'clock at night, water which had not been running on a certain consumer's premises began to flow freely; and on inspection being made it was discovered to be going first into a tank and afterwards into two ponds. One pond was in a meadow in which there were forty head of cattle. This misuse of the Company's water had been going on, to their knowledge, for three nights; and they estimated that about 12,000 gallons had been taken in this time. The defendant admitted that he had done a silly thing; but he said it was not so bad as the Company had made out. He was fined £3 18s. for fixing a pipe to a surface drain, and £2 8s. for unlawfully using water. There was a sequel to this case. The Company

summoned the consumer in respect of 182,000 gallons of water used in the way indicated; and the amount claimed was £9 2s. For the defendant it was urged that there was no evidence to prove that the water had been running for three months; but he was quite prepared to pay for 10,000 gallons. The Bench decided that 18,000 gallons had been used. The defendant's solicitor at once accepted this decision, and undertook to pay for the quantity named.

A rather unusual case came before the Magistrates at the Altrincham Sessions in September. It was an application on behalf of the North Cheshire Water Company for the committal of a man, who had been residing at Sale, for non-payment of water-rent and costs. The defendant had been summoned two months previously, and had failed to appear; and his goods were marked on a distress order. It was then found that the furniture was already in possession of another party for rent. A further order was granted, calling on the defendant to show cause why he should not be committed; but as he could not be found, the order was served at his last known place of business. As he did not appear in Court, the Company's representative asked for a committal order. The Bench, however, decided there was not sufficient evidence to justify them in granting it.

The financial affairs of several companies have been before the Courts during the year. In the Chancery Division of the High Court of Justice, Mr. Justice Parker had before him early in February a motion on behalf of a debenture-holder for the appointment of a Receiver in the case of the South Lincolnshire Water Company, Limited. It appeared that the Contractors for the works had failed to complete them. The Directors had resigned, and a new Board had been appointed who had tried to raise more money; but they had been unsuccessful. They therefore left the matter in the hands of the Court. His Lordship appointed Mr. William Cash as Receiver. In the King's Bench Division, a few weeks ago, Mr. Justice Bray and Mr. Justice Banks had before them an appeal in an action resulting from a deal in shares in the Bungay, Harleston, and Eye Water Company, in which fraudulent misrepresentation was alleged. The vendor of the shares was Mr. E. O. Preston, who arranged with the Solicitors of the Company to send out a circular in their name offering the shares and some debentures for sale. On the strength of a statement in the circular that the Company would pay interest at 6 per cent. pending the construction of the works, the shares were purchased by an ironmonger at Sandwich. But when he applied for his interest he was referred to the seller of the shares, who was a bankrupt. The purchaser then brought an action in the Sandwich County Court against the Solicitors; but the Deputy-Judge held there was no evidence to go to a jury. In the Divisional Court, it was submitted, on behalf of the defendants, that they never concealed the fact that Mr. Preston was the vendor of the shares; and that the sale could not possibly have been taken as having been made by the Company. Their Lordships thought the Judge in the County Court had gone wrong in saying the circular was not capable of bearing the construction the plaintiff had put upon it; and they decided that the case must go for a new trial in the High Court. Plaintiff's appeal was allowed, with costs. Mr. Justice Neville had before him a debenture-holder's action in connection with the St. David's Water and Gas Company. The debentures, which charged the whole undertaking of the Company, bore interest at the rate of 4 per cent.; and the interest was in arrear. The plaintiff asked for the appointment of a Receiver; and his Lordship made the usual order. The same Judge was asked to confirm resolutions for the reduction of the capital of the City of St. Petersburg New Water-Works Company, Limited. The capital was originally £200,000, in £20 shares; in 1895 and 1899, it was reduced to £111,000, in £11 shares; and it was proposed to bring it down to £80,000, in £8 shares. His Lordship sanctioned the reduction.

In the Chancery Division of the High Court of Justice, Mr. Justice Parker had before him on two days a special case, stated by consent, in which the opinion of the Court was sought on the question of the appropriation of the surplus funds of the Weymouth Water Company—in other words, the payment of "back-dividends." The Company had two classes of shares—old and new; and the aggregate deficiencies of dividends on the former down to 1908 were stated to be upwards of £50,000, while the deficiency on the latter was upwards of £2000. The Company were desirous of using their surplus for making up past deficiencies; but some questions had arisen as to how this should be done as between the two classes of shareholders. On behalf of the holders of the old class of shares, it was submitted that, as there was a large deficiency in their case and a much smaller one in the other, it would be just to divide the extra dividend in the same proportion; or, alternatively, to give £10 to the old for every £5 to the new shares. For the holders of these shares, it was argued that an equal division would be in accordance with the true construction of the various Acts of Parliament. His Lordship said he thought the proper way was to treat the extra dividend as one payable for the year, and to preserve the same proportion between the total dividends paid to the two classes of shareholders as existed by Statute with regard to the maximum dividend—*i.e.*, if a dividend of 12 per cent. was paid upon the 10 per cent. maximum shares, 6 per cent. should be paid on the 5 per cent. shares. This could be done until all the arrears upon the new shares had been paid off; and thenceforward no higher dividend than 5 per cent. could be paid on those shares. The same thing would take place in the case of the old shares. This seemed to him to be in accordance with the Act, and also just to the parties.

Rating questions and arbitrations, being in the nature of legal proceedings, may be conveniently referred to here. The Justices at the Preston Quarter Sessions some time ago had before them a test case to determine whether the Corporation of Liverpool were liable to be rated for the gathering-ground in connection with their Rivington Water-Works, and how far a general principle in respect thereto could be laid down. The Court were asked by the Chorley Union and by the Overseers of Withnell to declare that the Corporation were owners and occupiers of the land, and that £1 per acre was a fair value to place upon the acreage with which they were concerned. For the Corporation, it was submitted that the mere enclosure of property, as in this case, did not amount to rateable occupation; and even if it were otherwise decided by the Court, the land was not worth £1 per acre per annum. A considered judgment was given by Mr. H. Worsley-Taylor, K.C., the Chairman, in favour of the Corporation on both points. He, however, consented to state a case for the opinion of the Higher Court; and it came before the Lord Chief Justice, Mr. Justice Hamilton, and Mr. Justice Avory, early in the year. The points submitted to them were these: (1) That the Corporation of Liverpool were not in rateable occupation of the land in question, with the exception of the parts used by them for plantations and nurseries. (2) That the plantations and nurseries should be assessed, under section 4 of the Rating Act, 1874, at 2s. per acre and 15s. per acre respectively. (3) That the price paid by the Corporation for the gathering-ground was no evidence of the rateable value of the land used for plantations and nurseries. The Lord Chief Justice, in a long and elaborate judgment, held that the Corporation were in rateable occupation of all the ground; but on the other points he considered that the judgment of the Court below was right. Mr. Justice Hamilton and Mr. Justice Avory delivered judgment to the same effect. The Corporation appealed against this decision; and the case came before Lords Justices Vaughan Williams, Buckley, and Kennedy on the 16th of October. The arguments for the appellants, for whom Mr. Balfour-Browne, K.C., Mr. Macmorran, K.C., and Mr. Oulton appeared, occupied the whole day; and on the following morning Mr. Ryde, K.C., argued the case for the respondents in the absence of his leader (Mr. Danckwerts, K.C.) through illness. The arguments were proceeded with on three days last month; and judgment was reserved. It was given last Thursday, and, as will be seen from the report which appears elsewhere, the appeal was dismissed, and the case sent back to the Court of Quarter Sessions for their decision as to the assessment and value.

On the 10th of January, arbitration proceedings were opened at the Surveyors' Institution, Westminster, to determine the price to be paid by the Worksop Urban District Council for the undertaking of the Worksop Water Company, under the Act sanctioning the purchase obtained by the Company in the session of 1910. Mr. F. Fowler and Mr. E. Willcox were Arbitrators for the Company and Council respectively; and Mr. A. J. Ram, K.C., was the Umpire. The Company's estimate of the value of their undertaking was £83,057. The Council, however, considered that £48,927 was a fair price to be paid for what they held as a 4 per cent. investment. The inquiry lasted five days. The award was made very shortly after the

close of the proceedings; the price fixed by the Umpire being £64,612. This was about £18,000 less than the amount claimed and £16,000 more than the Council's offer. A few weeks later, arbitration proceedings took place in London in regard to a claim made against the Sheffield Corporation by Mr. W. Wilson, of Beauchief Abbey, for compensation for an easement in respect of the water tunnel constructed beneath his property at Stanage and Hallam Moors in connection with the Redmires and Rivelin reservoirs of the Corporation. The amount of the claim was £5000; being £1450 for the easement and £3550 for injurious affection of the grouse moor. The value of the easement was reduced to £1353.

An important action, arising out of the new water scheme of the Lincoln Corporation, to which reference has already been made, occupied Mr. E. J. Pollock, one of the Official Referees of the Supreme Court of Judicature, for seven days in the Nisi Prius Court at Lincoln Castle. The plaintiffs were the Staveley Coal and Iron Company, Limited, and they claimed from the Corporation a sum of £15,778, under a contract, of which the total was £28,406, to supply cast-iron pipes for the main in connection with the scheme. The Corporation said the pipes which were the subject of the claim were some that had been rejected, but had been renumbered and sent back as having been passed; and they made a counterclaim of the same amount as the Company's claim. At the opening of the proceedings on the seventh day, Sir Edward Carson, who was the leading Counsel for the plaintiffs, stated that certain information had on the previous day come to the knowledge of the Managing-Director of the Company, which satisfied him that they ought not to further contest the right of the Corporation to have the contract terminated. The moment there were reasons for supposing that the pipes had been improperly dealt with, the Managing-Director did not hesitate to give him (Sir Edward) instructions to the effect he had stated. Counsel submitted the terms of the arrangement come to, and said the Company would, of course, pay defendants' costs on both the claim and the counterclaim. Mr. Hugo Young, K.C., who, with Mr. J. B. Matthews, conducted the case of the Corporation, said he was not surprised that the Company had taken the course they had done, which he regarded as most creditable to them in the circumstances. The Official Referee congratulated both parties and everybody concerned upon the result. The case, which, including a day spent in visiting the Company's works, had occupied the Referee eight days, and had cost, according to a statement made by Sir Edward Carson during the proceedings, £3 10s. per minute, was then brought to a close.

The quality of the water supply gave rise to some proceedings at Ossett and Swanage. At the former place, the Dewsbury and Heckmondwike Water-Works Board sued the Ossett Corporation for £50, the balance of an account. The Corporation alleged that they had been supplied with dirty water which they ran to waste; and they deducted the sum in question from the Board's account. The County Court Judge thought the defendants had established a case for some small damages for breach of warranty; and he gave judgment for the plaintiffs for £40, with costs. At Swanage, an agitation in regard to the water supply culminated in an application by the Urban District Council to the Magistrates in Petty Sessions for an order for the compulsory closing of two suspected wells of the local Gas and Water Company. After a consultation between Counsel representing the parties, an agreement was come to under which the supply from one well was to be discontinued altogether, and the summons with regard to the other was to be withdrawn on the Company undertaking to procure a supply from other sources which would enable them to discontinue drawing from that well. The Bench made an order in accordance. It was stated in the course of the proceedings that since 1897 the Directors of the Company had spent £20,000 in searching for a supplementary supply.

Technical Business.

Coming to the technical matters connected with water supply which have engaged attention during the year, the two meetings of the Association (now the Institution) of Water Engineers claim attention first of all. At the summer meeting, which was held at Buxton in May, under the presidency of Mr. Edward Sandeman, the Engineer to the Derwent Valley Water Board, the members received a cordial welcome from the District Council, conveyed through the Chairman, Mr. W. H. Mill, J.P. The Inaugural Address of the President furnished the information that the Council of the Association had been engaged in drafting a Scheme of Incorporation, under licence from the Board of Trade; and this change was regarded as desirable in the interests of the members. The President pointed out that year by year the position of the Association had improved; and, judging by the membership, by the yearly volume of "Transactions," and by the work generally, he thought the prospects were in every way favourable. The total number of members had increased from 376 in 1910 to 387, of whom 221 were ordinary and 125 associate members. The rest of the address was devoted to the subject of constructing impounding reservoirs, and it included some interesting examples of curved and straight gravity dams. The papers read and discussed dealt with the filtration of public water supplies and their sterilization by ultra-violet rays, the geology of dam trenches, and the water supplies and river basins of England and Wales. These communications, with some notes of the remarks made thereon, appeared in the "Journal" at the time. The members paid a visit to historic Haddon Hall, and inspected the great works with which the President is associated, and which it is hoped will be opened by the King next July.

At the winter meeting, held in London on the 8th and 9th inst., under Mr. Sandeman's presidency, the members discussed an important report submitted by the Water Areas and Statistics Committee on the subject of the legislative needs in connection with water supply. The Committee came to the conclusion that, in view of the many points to be dealt with in consolidating water legislation, it was essential that any Bill introduced for the purpose should be referred to a Joint Committee of both Houses, with power to call for evidence on behalf of all the interests affected. The report was unanimously adopted; and the Council were authorized to take all possible steps towards accomplishing the suggestions contained in it. Three papers, dealing respectively with the use of portland cement on public works, the management of water-works, and the new water-works at Skegness were upon the *agenda*. The first two were read and discussed; and the third (by the Secretary, Mr. Percy Griffith) was taken as read, and its discussion postponed till the summer meeting, which will take place next June at Cheltenham, the home of the new President, Mr. J. Spiers Pickering, M.Inst.C.E., the Water Engineer to the Corporation.

Next to the Institution of Water Engineers, the proceedings of the Society of Engineers, so far as they relate to water supply, may be noticed. "The Administrative Aspect of Water Conservancy" was dealt with in a paper by Mr. W. R. Baldwin-Wiseman, Assoc.M.Inst.C.E., who outlined an administrative system comprising a central authority controlled by a Minister of Water Supply supervising Main Drainage and River Boards. He has been awarded the President's Gold Medal for his paper. Before the same Society, Mr. H. C. H. Shenton read a paper on "The Protection of Water Supplies," in which he discussed the difficulties in the way of deciding on standards of purity for water and of danger from pollution.

At the Birmingham University, Professor Percy F. Frankland, F.R.S., gave a lecture to the members of the Midland Section of the Society of Chemical Industry, on "The Bacteriology of Water," in which he insisted upon the chemical and the bacteriological examination of water supplementing each other. At the Royal Institution, Mr. J. H. Balfour Browne, K.C., delivered a very interesting lecture on "Water Supply," in the course of which he spoke highly of the view taken by the Joint Select Committee on the Water Supplies Protection Bill in regard to the great question of the national water supply, which they thought should be conserved in all reasonable ways. "Water and Petroleum Boring and Machinery" was the subject of a paper read before the Association of Engineers-in-Charge by Mr. W. H. Booth, who had something to say about water diviners, whose operations were dealt with in a communication made to the Royal Society of Arts by Professor Wertheimer, who has made a special study of the subject. It will not be out of place to mention, in this connection, that the question of the payment of a water diviner for his services came before the Local Government Board early in the year. The Redcar Urban District Council had employed the diviner, and the District Auditor had refused to pass the amount paid to him, on the ground that they did not select a properly qualified person, and did not act with the diligence and prudence they were bound to exercise.

The Council made an appeal, and the Local Government Board upheld it, as the Council had previously adopted satisfactory advice given to them by the diviner in question. The Croydon Water-Works were described by Mr. G. F. Carter, the Borough Surveyor and Water Engineer, in some notes on "The Public Works of Croydon" submitted by him to the Home Counties Section of the Institution of Municipal and County Engineers; and those at Ipswich were incidentally referred to in the course of a lecture given by Mr. C. W. S. Oldham, the Engineer and Manager, to the local Engineering Society, on "The Water Supply of Ipswich and the County of Suffolk." Among the literature connected with water supply published during the year, reference may be made to the collection of statistics included in the final part of the series of tables summarizing the preliminary results of the returns received by the Board of Trade under the Census of Production Act, 1906. These statistics were given in the "JOURNAL" for Sept. 26.

CASUALTIES.

The list of accidents in connection with the supply of water during the year is happily a short one; and, fortunately, no fatalities have to be recorded. Inconvenience was caused in the Lower Saltley district of Birmingham in June by the bursting of a water-main and the consequent flooding of a gas-main. About the same time, one of the mains conveying water from Lake Vyrnwy to Liverpool burst in a field at Cote Brook, a village about eight miles from Northwich. It was a 42-inch main, and was laid at a depth of about 12 feet. Some two or three million gallons of water escaped. June was marked by another accident of the same kind, this time in London. The socket end of a large main in Essex Road, Islington, burst on the night of the 11th, and blew out a piece of pipe measuring 24 in. by 36 in. The escaping water tore up a portion of the roadway and flooded the neighbouring houses, in some cases to a depth of 5 feet. The cause of the break was thought to be local contraction owing to change of temperature. A few weeks later, considerable damage was done to the carriage drive at Milner Field, Saltaire, by the bursting of a 30-inch main belonging to the Bradford Corporation; and also to the Edgware Road, London, by the rupture of a main that forms part of the distribution system of the Metropolitan Water Board. One of the Board's 30-inch trunk mains, connecting Islington with Battersea, burst in Parliament Street early on the morning of the 22nd of August; and the previous day a similar accident occurred to a pipe in Praed Street, Edgware Road. A few days later, a smaller pipe burst in Holborn. The Manchester Corporation had a 12-inch pipe burst, causing damage to about 80 yards of roadway and the flooding of property; and one of the mains conveying water from the Elan Valley reservoir to Birmingham gave way at a point on the Builth Road, about half-a-mile out of Rhayader. Other bursts occurred at Fareham, on a main of the Gosport Water Company, and on a 36-inch main of the Glasgow Corporation at Milngavie. A curious accident occurred in August at the pumping-station of the Portland Water-Works, by which the inhabitants of the town were deprived of water, owing to the escape of paraffin into one of the wells. The whole of the water at the works (estimated at 100,000 gallons) had to be pumped to waste before drinking water was obtainable.

PERSONAL MATTERS AND DEATHS.

Before closing this retrospect, a few personal matters which have occurred during the year call for brief notice. Mr. S. J. Dunn, who for many years held the position of Superintendent of the Salford Corporation Water Department, relinquished it at the end of November, and Mr. L. H. A. Gaunt, of Warrington, has been appointed Water Engineer and Manager. Mr. George Greenslade, the Engineer of the South Hants Water Company, resigned on account of ill-health, after thirty-two years' service; and he has been succeeded by Mr. Dawson Kitchingman, the Water Engineer to the Poole Corporation. On the occasion of the annual summer outing of the staff and employees of the Company, Mr. Greenslade was presented by them with an illuminated address; and in acknowledging it he mentioned that he had received a handsome silver salver with the names of the Directors inscribed upon it. Mr. W. G. Greenslade was also presented with a testimonial in recognition of his marriage. After seventeen years' service with the Tonbridge Water Company, in the capacity of Engineer, Secretary, and Manager, Mr. James Lees retired, and received an expression of the appreciation by the Directors and shareholders of the energy he had displayed during his administration of the Company's affairs. Mr. Cecil H. Roberts, the Water Engineer of the Corporation of Southampton, obtained a similar position with the Corporation of Aberdeen; and he was succeeded by Mr. E. C. Rodda, B.Sc., from the office of the City Engineer of Sheffield. Early in September, the retirement was announced of Mr. C. Sainty, the Manager of the Windsor Water-Works, after many years' service in connection with the Corporation. The Council passed a resolution conveying their thanks to Mr. Sainty for his long services, and for the loyal and steadfast way in which he had carried out his work. Mr. Sainty is a Past-President of what is now the Institution of Water Engineers. Mr. E. A. Stickland, the Borough Surveyor of Windsor, has been entrusted with the management of the water-works, in succession to Mr. Sainty.

The completion by Mr. W. W. Gray of twenty-five years' service as Engineer and Manager of the Cambridge Water Company, with which undertaking he had been associated for forty-five years, in the above-named capacities and also as Secretary, was chosen by the Company's staff as being a suitable occasion for expressing in a tangible manner their respect and esteem for him. This was done early in the year at a dinner held at the Lion Hotel, Cambridge, at which the then Mayor (Alderman George Stace), one of Mr. Gray's oldest friends, presided. The presentation took the form of a gold sapphire ring, an enlarged portrait of the recipient, and framed photographs of the Company's pumping-stations at Cherryhinton and Fulbourn. The gifts were presented by the Mayor; and in acknowledging them Mr. Gray reviewed his long connection with the Company, and said he was glad to know that what services he had rendered to the staff had been appreciated. Another instance of long service was recognized by the inspectors of the Bolton Corporation Water Department, by the presentation to a colleague —Mr. James Hunt—of a gold watch, chain, and seal, on completing fifty years' connection with the undertaking, and as a mark of their regard and esteem. A gold brooch was handed to Mrs. Hunt. Recognition of another kind, in the shape of increases of salary, were received by Mr. F. W. Lillicrap, the Water Engineer of the Devonport Corporation, and by Mr. Alfred Peirce, the Assistant Water Engineer at Richmond (Surrey).

In the course of the year we have unhappily had to record the removal by death of several gentlemen closely connected with water-works undertakings. They were: Sir John Aird, Bart., the head of the well-known firm of Contractors; Mr. Lawrence W. Adamson, a Director of the Newcastle and Gateshead Water Company; Mr. R. C. F. Annett, the Chief Clerk and Assessor of Water Charges to the Liverpool Corporation; Mr. George Banbury, for many years Chairman of the East London Water Company; Mr. Edmund Boulnois, formerly Chairman of the West Middlesex Water Company; Professor Sir Rubert Boyce, the Water Examiner to the Corporation of Liverpool; Mr. Edward Filliter, who was for some time associated with Mr. Henry Rofe as a water engineer in Leeds; Sir Henry Harben, a Director of the New River Company; Mr. John Kitson, formerly Chairman of the Water Committee of the Torquay Local Board; Mr. Frederick Morse, one of the founders, and for a long time Chairman, of the Lowestoft Water and Gas Company; Mr. Henry Robinson, for some years Engineer of the Stockport Water Company; Mr. G. E. Saville, the first Engineer and Manager of the Holyhead and North Wales Gas and Water Corporation, Limited, and subsequently in practice as a consulting engineer at Southport; and Mr. Francis Tagart, a Director of the Grand Junction Water Company.

Society of Engineers (Incorporated).—At the second annual general meeting of the Society, which was recently held at the offices, the report of the scrutineers of the ballot-papers for the election of Council and officers for 1912 was presented. Mr. John Kennedy is the new President, and Mr. Arthur Valon one of the Vice-Presidents. Among the members of the Council are Mr. Percy Griffith, the Secretary of the Institution of Water Engineers, and Mr. H. P. Maybury, the Surveyor to the Kent County Council. Among the premiums presented for papers read at the meetings during the past session was the President's Gold Medal to Mr. W. R. Baldwin-Wiseman, for his paper on "The Administrative Aspect of Water Conservancy," which was noticed in the "JOURNAL" for the 25th of April (p. 236). A resolution was passed thanking the other gentlemen who had presented papers during the year, some of whom, being members of the Council, were not eligible to receive premiums.

THE CARBONIZATION OF COAL.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[The Fourth, and Last, of a Series of Cantor Lectures delivered before the Royal Society of Arts, Dec. 18.]

If we distil coal at a fixed temperature, as has been pointed out, we know that in the distillates we have the volatile products yielded at all temperatures below the one employed, and such secondary products as have been formed by further decompositions or by interactions between the primary products at or below that temperature. So that if we distil coal in bulk at the lowest temperature at which volatile matter can be driven out from the coal, the analyses of the products will give us the maximum of primary products with the minimum of secondary, and we shall obtain the best possible data for forming an opinion as to the composition of coal on the one hand, and the course taken by the interactions and decompositions in the secondary actions.

Low Temperature Distillation.

In the experiments that led to the introduction of coalite, it was found that 420° C. (800° Fahr.) was the lowest temperature that could be employed successfully, and many thousand tons of coal have been distilled at about this point—say from 400° to 500° C. Under these conditions, a fair gas coal, containing 30 to 33 per cent. of volatile matter, will yield 68 to 70 per cent. of low temperature coke, containing 10 to 14 per cent. of volatile matter and a volume of gas varying from 3000 to 5000 cubic feet, according to the coal used, having a composition approximating to:

	Per Cent.
Hydrogen	27·5
Saturated hydrocarbons—	
Methane	48·0
Higher members	10·1
	58·1
Unsaturated hydrocarbons	3·0
Carbon monoxide	7·3
Carbon dioxide	2·5
Nitrogen	1·6

The gas before oxide purification contains about 1·8 per cent. of sulphuretted hydrogen.

The low temperature gas, of course, varies with the coal used. The hydrogen is often below 18 per cent., and the saturated hydrocarbons up to 68 per cent. But the marked feature of the gas is that it contains hardly any benzene vapour, and owes its illuminating power to a small percentage of ethylene and chiefly to the gaseous members of the paraffin series (mostly ethane), and also that the percentage of hydrogen is low—very rarely reaching the amount present in the above sample. Bisulphide of carbon likewise is very low. This I pointed out in the last course of Cantor Lectures which I gave in March, 1908; and it has since been confirmed by the work of Porter and Ovitz, White, Park, and Dunkley, and Burgess and Wheeler.

The tar also varies with the coal used, and is sometimes as high as 23 gallons per ton, and in most cases averages 20 gallons. The low temperature tar is as distinctive in its characteristics as the gas. It has a specific gravity of about 1·075, is very liquid, and contains an abundance of light solvent oils, very low aromatic hydrocarbons, very little phenol but large quantities of cresol, no naphthalene, and very little anthracene. The free carbon is as a rule below 2 per cent. The very low percentage of benzene in the light oils is made up for by the presence of paraffins, such as hexane, heptane, and octane; while there are also present considerable quantities of that curious group of hydrocarbons known as naphthenes or hexahydrobenzenes, which play so important a part in Russian petroleum.

As before mentioned, carbolic acid occurs in very small quantities; but its higher homologues, such as cresylic acid, &c., occur in much larger quantities than in coal tar. There are also present quantities of polyhydric phenols or other esters of the type met with in coal tar, which form resinous masses difficult to investigate. The pitch left as a residue amounts to about 40 per cent. of the tar, and is of very fine quality, owing to the practical absence of free carbon.

A very complete investigation of this low temperature tar has been made by Mr. J. S. Brame, in the laboratories at Greenwich, and will be published elsewhere. The average tar yielded by the coal gave on distillation the following results:

Specific gravity . . . . . 1·073

Distillation on 2274 c.c. (0·5 gallon).

		Percentage by Volume on Tar.	Specific Gravity.	Volume of Hydrocarbons.	Tar Acids Recovered.
Water		2·64			
Light oil, to	170° C.	3·10	·844	3·10	—
Carbolic oil	170°–225°	13·72	·959	8·62	4·8
Creosote oil	225°–240°	8·35	·9885	4·64	3·1
" "	240°–270°	8·35	·9923	5·45	2·55
Anthracene	270°–300°	8·80	1·029	6·60	1·76
"	300°–320°	12·31	1·033	8·80	3·10
Pitch, by weight on volume		41·71			
Bases recovered		1·32 per cent.			

Light oil, percentage distilling below—		Calculated on Tar.	
100°	15·6 by volume	0·55	
120°	31·2	1·09	
140°	54·7	1·91	
170°	82·8	2·90	
over 170° and loss	17·2 } 100	0·20 }	3·10

The ammonium sulphate amounted only to 12 lbs. per ton of coal; the temperature being too low for large production.

Primary and Other Products of Decomposition of Coal.

From these results it seems more than probable that the primary products of decomposition of the coal are those which are produced during the actions taking place in its formation—*i.e.*, methane, carbon dioxide, and water—*plus* those compounds formed by the rising temperature, and consisting of the first nine or ten members of the paraffin series, naphthenes, and oxygenated hydrocarbons like cresylic acid. The action of heat upon these starts at once secondary reactions, and gives us gaseous and liquid compounds identified in low temperature gas and tar; while at higher temperatures these, in contact with the highly-heated coke envelope of the decomposing coal, undergo further actions, analytic and synthetic, and, becoming diluted with the poor gas from the residual pitch left in the coalite, yield the high temperature coal gas and tar.

When coalite that has been formed with the evolution of 5000 cubic feet of 22-candle power gas, as measured by the No. 2 argand, is further heated to a high temperature, it evolves nearly as much gas as it did before; and the percentage composition of this gas is approximately: Hydrogen, 71·13; saturated hydrocarbons, 18·26; unsaturated hydrocarbons, 0·52; carbon monoxide, 6·30; carbon dioxide, 2·09; nitrogen, 1·70. The gas is practically non-luminous when burnt alone, but has a heating value of 447 B.Th.U. gross. It seems clear from these experiments that in the distillation of coal for gas there are three distinct sources which give the final product:

1—The primary gases evolved from the coal, and which are distilled out as the advancing temperature travels through the mass.

2—The gas evolved by the decomposition of the heavy tar or pitch left in the coking mass.

3—The gas produced by secondary actions, and contact of the primary gases and vapours with the hot coke and walls of the retort.

It now becomes possible to trace roughly the actions taking place in the destructive distillation of a gas coal. Up to about 450° C., the products are chiefly primary:

Humus Bodies.		Resin Bodies and Hydrocarbons.
Carbon—		
Water Carbon monoxide Carbon dioxide Hydrogen Methane	gases	Methane Ethane Propane Butane
Coke and pitch—		
Watery tar	liquids	Pentane Hexane Heptane Octane Nonane Hexahydrides Oxygenated hydrocarbons like cresylic acid and more complex bodies.

At about 400° to 450° C., the secondary actions start, the saturated hydrocarbons split up into unsaturated and simpler members of the saturated series, the hexahydrides shed hydrogen and give aromatic hydrocarbons, the tar thickens and alters in character, and synthetic actions start, cresol and hydrogen form more toluene, and carbolic acid and carbon yield carbon monoxide and benzene. At about 900° C., the degradation of all the hydrocarbons and other oxygenated bodies is proceeding, and finally the mixture of the results of endless actions and reactions yields us the high temperature gas and tar; the mixture being diluted with the carbon monoxide, hydrogen, and methane yielded by the decomposition of the pitch residues in the soft coke, which leaves the hard coke behind.

After-Effect of Heated Surfaces on Gas.

All our carbonizing processes, from the horizontal retort to the latest oven or chamber process, are smirched with the same defect; and that is the after-effect of heated surfaces and red-hot coke on the gas. I have elaborated in much detail the fact that there is not a single factor of uniformity in our ordinary methods of carbonizing; and there never can be with most of the proposed new processes. The coke-oven manager is in much the same plight; but he does achieve to a great extent what he is aiming at—that is, to keep all the carbon he can in the coke. The gas manager's aim is just the reverse. He desires all the carbon he can obtain in the gas; and few of the proposed methods of carbonization go the right way to secure it—indeed, the only approach to it is in continuous carbonization.

No matter what temperature is used—the heats may be pressed as high as the material of the retorts and the flues will stand—the temperature of the distillation of the coal will be the lowest temperature at which it evolves gas; and if one looks back to Lewis Thompson Wright's classical work on the influence of temperature on carbonization, it will be found that the coal fed into a retort at the highest attainable temperature gives for the first ten minutes a rush of gas having much the same composition as coalite gas [see table, next page].

It will be seen that not only is the gas given off in the first ten minutes of the charge nearly identical in composition with coalite gas, but also that the gas yielded in the last period of carbonization is nearly the same as that obtained by the further distillation

	Time after Commencement of Carbonization. 10 Min.	1 Hr. 30 Min.	3 Hr. 25 Min.	5 Hr. 35 Min.
Hydrogen	20·10	38·33	50·68	67·12
Methane	57·38	44·03	35·54	22·58
Hydrocarbons	10·62	5·98	3·04	1·79
Carbonic oxide	6·19	5·68	6·21	6·12
Carbonic acid	2·21	2·09	1·49	1 50
Sulphuretted hydrogen	1·30	1·42	0·49	0·11
Nitrogen	2·20	2·47	2·55	0·78
	100·00	100·00	100·00	100·00
Carbon density of hydrocarbons	2·86	3·11	3·38	2·29

of the coalite; while during the intermediate five hours of the charge the gases evolved have been mixtures of the primary gas in various conditions of secondary change, diluted with the residual gas from the partially coked coal on the exterior of the charge—the secondary changes being brought about by contact between the primary gas, tar vapours, and wall surface, passage through the skin of red-hot coke, and radiant heat.

With a good Durham coal capable of yielding 11,000 cubic feet of gas and 10 gallons of tar per ton, when distilled under ordinary conditions at a temperature of about 1000° C., it is found that on carbonizing at 600° C. it yields only 5000 cubic feet of gas, but 22 gallons of tar, per ton; and the residue, on continuing the distillation at 1000° C., yields a further volume of 4500 cubic feet of gas, but no tar. So that removing the gas first formed and the tar vapour from the secondary reactions induced by high temperature has reduced the gas yield by some 1500 cubic feet per ton, and increased the tar yield by 12 gallons. An examination of the tar shows that the 12 gallons gasified by direct distillation at a high temperature consist of the lighter portions of the whole of the tar, which at this temperature is capable of producing 1200 cubic feet of gas; leaving 300 cubic feet to represent the volume gained by the degradation of the gaseous hydrocarbons and the deposition of the free carbon, of which the high temperature tar contains 25 to 35 per cent.

It may be taken, in round numbers, that when 11,000 cubic feet of gas are obtained per ton of such a coal, 45 per cent. of the volume is from the low temperature distillation, 42 per cent. from the residues left in the low temperature coke distilled at a high temperature, and 13 per cent. from the various secondary actions and tar. When tested by the No. 2 argand, the low temperature gas has a candle power of 22, the gas from the pitch in the coke is nearly non-luminous (giving not more than 2½ to 3 candles, but when mixed with the rich gas in the proportions of 45 of the latter to 41 of the former gives a 16 to 17 candle gas), while the gas from the tar and the secondary actions is 10-candle gas when tested alone, and when mixed with the others brings down the the total candle power to 14 to 15 candles.

In the new methods of carbonization, where makes approximate to 13,000 cubic feet, the improvement found is entirely due to the free escape without over-heating of the products from the first two-thirds of the coal carbonized, while the extra volume is obtained from the complete degradation of the products from the remaining third; and that this is so is shown by the methane in the gas. In all fair coal gas in which there has been no over-degradation, even if one has been getting 11,500 cubic feet per ton from light charges, the methane will be about 34 to 35 per cent. of the gas. But notice the products of the new carbonization, and plenty of samples will be found with only 28 per cent., and some even lower.

In considering the ultimate effect of pushing temperatures to the highest possible extent, it is as well to consider the amount and value of the gas and coke that could possibly be obtained from an ordinary coal. If we took a coal of the following composition: Carbon, 80 per cent.; hydrogen, 5 per cent.; oxygen, 10 per cent.; nitrogen and ash, 5 per cent., and were to carbonize it in an inverted vertical retort, with the coal fed in by a ram at the bottom, so that the gas and vapours had to traverse a column of 10 feet of coke at 1000° C., contact would decompose all the gaseous and volatile compounds to hydrogen and carbon monoxide. We should then obtain:

Coke	15·27 cwt.	
Hydrogen	22,400 cubic feet	= 77·87 per cent.
Carbon monoxide	6,366 ,, ,,	= 22·13 per cent.
	28,766 ,, ,,	

That is, you would rather more than double the volume of gas. But it is a non-luminous gas of the same thermal value (gross) as water gas, and not worth more than the 3½d. to 4d. per 1000 cubic feet that you could make water gas at by one of the newer processes. Certainly you get an increase in the quantity of coke; and it would be excellent metallurgical coke.

Now this is exactly what is done in all new processes directly the cool passage for the escape of the primary gas gets tar-logged, and the gas from the remaining coal is driven through the red-hot coke and along the sides of the retort. Under these conditions, some 3500 cubic feet of 22-candle gas are obtained while there is a free cool passage for its escape. After this is closed, the remaining coal yields, by the complete degradation of the tar and hydrocarbons, 9500 cubic feet of hydrogen and carbon monoxide. And gas people take pride in 13,000 cubic feet, instead of being heartily ashamed of it. Of course, there is the saving factor that between the good primary gas and the relics of ruined hydrocarbons there is a lot of only partly destroyed gas from the coal and tar near to the mouthpiece; so that the make averages out at 15 candles, and the cool distillation of the tar from the first two-thirds of the coal yields two-thirds of the 20 gallons that would have been obtained had it all been distilled in the same way. This is the secret of the new process tar being 13 to 14 gallons per ton, more liquid, and more paraffinoid in its nature.

In continuous carbonization, it is claimed that degradation does not take place. But the make and the methane in the gas tell their own tale; and the fact that the charge is always fairly cool in the top 3 feet of the retort, and is of nearly the full breadth of the retort, is made up for by the rapid tailing of the uncarbonized portion, which soon makes the cool inner core an impossibility, while it must be tar-logged for a considerable distance.

Carbonizing Results from Various Processes.

During the past few years, a perfect tornado of results from every kind of carbonizing process has burst upon the gas profession; and as the same class of coal has hardly ever been used, and as the experimental methods employed have differed even more widely than the coal, the results, as a basis of comparison between the various processes, have been for all practical purposes of little or no use. In order to obtain from these results something like a comparison, I have taken the figures obtained by the most practised observers, and have translated them by comparison into terms of a good North Country gas coal carbonized to give a yield of 15-candle power gas, as tested by the "Metropolitan" No. 2 burner, and having a thermal value of 540 B.Th.U. gross, taking the results to the nearest 500 cubic feet.

Horizontal. Six-Hour Charges.	Horizontal. Twelve-Hour Charges.	Gas Make. Intermittent Verticals.	Continuous Carbonization. Woodall-Duckham.	Continuous Carbonization. Glover-West.	Chamber Carbonization.
11,500	13,000	13,000	13,000	13,500	12,500

That is to say, the horizontal retort, well filled, gives yields equal to the intermittent verticals or Woodall-Duckham continuous verticals, and is superior to chamber carbonization—being surpassed only by the Glover-West continuous vertical retorts, which owe their superiority to the engineering skill with which the various parts are designed and to the regeneration of the secondary air.

When we take the four leading systems, and try to differentiate between them by the important item of fuel consumption, we find the best practice gives per 100 lbs. of coal carbonized:

Horizontal.	Intermittent Verticals.	Continuous Carbonization. Woodall-Duckham.	Continuous Carbonization. Glover-West.
14	15	12·1	10·3

So that here, as one would expect, the withdrawal of heat from the coke, and utilizing it to heat the secondary air, gives the Glover-West process an advantage.

If we now take cleanliness of working, amount of nuisance to the neighbourhood of the gas-works, and uniformity in composition of the gas during the period of carbonization, the continuous vertical retort stands alone. It is an impossibility to shoot or feed a heavy charge of raw coal into a red-hot retort without getting an out-rush of steam and smoke that permeates the atmosphere for a considerable distance, and means not only loss but stench. They also give the further advantage that the coke, being cooled in the bottom chamber of the retort, needs little or no spraying when drawn; and steam is thus avoided.

The coke, tar, and sulphate of ammonia in all the new methods of procedure are an improvement on the products from the lightly-charged horizontal. So that, not only from the scientific, but also from the practical, point of view, the continuous vertical retort processes are the ones that show the real advance; and, what is still more important, they are the ones which offer a promise of improvement. There are other points, however, which the gas manager must take into consideration when choosing a process. These are the cost of an installation, the cost of labour, and the ground space the installation will occupy. At present, the cost of the vertical retort installation, be it intermittent or continuous, is in most cases just about double that of the horizontal. But, on the other hand, it must be credited with saving in labour and space; nor should it be overlooked that the horizontal retort has had a century of experience lavished on it, while the vertical is in its infancy.

I think I have said enough to show that, in my opinion, we are well ahead of Continental practice; and if any one asked my advice as to his present carbonizing methods, it would be to use full charges in horizontals until a scrapping of the plant becomes a necessity, and then instal a continuous vertical retort system.

Ideals for Perfect Carbonization—Continuous Verticals.

The ideals to be attempted in a perfect carbonizing process are a uniform treatment of every particle of coal distilled, a uniform treatment of the whole of the gas evolved, and, what is perhaps as important as anything, preventing the degradation of valuable hydrocarbons by contact with hot coke or other surfaces. I have shown the limitations of various processes; and there can be no doubt, in the minds of those who have studied the question, that the continuous vertical retort, when properly proportioned and worked, gives the only solution to the problem of uniformity in treatment to coal and products alike, and if scientific teaching is of any value they must be the type of gas-making retort in the future.

This, however, is not saying that I consider the two present systems are perfect, or anywhere near it. Already experiments

are being made in several directions to find further improvements. You will have noticed that I have said nothing about such installations as the Glasgow verticals, simply because it would not be fair to discuss them at present. I have my own ideas as to the lines on which to work in the future; but before I place them before you, I want to discuss another side of the question of carbonization from the gas manager's point of view, which must be placed in the front as a policy if gas is to do the work I hope for it in the future.

The Limit of Volume in Gas Making.

The limit of volume in gas making, if not already reached, is fast being approached. Economies are day by day getting more difficult to make, coal is not likely to cheapen; and all this means that the chance of considerable reductions in the price of gas is getting less and less. If the price could be reduced in our large cities to that charged at Widnes, the consumption of gas could be economically increased; and for power and heat gas would hold an unassailable position. But this can never be done, under existing circumstances, because, even if the gas could be made at the necessary price, the increased output of coke would outrun the demand. If, however, the companies would only live up to their titles of "gaslight" and "coke" companies, and bestow as much care on the coke as on the gas, and cater for the supply of a good domestic fuel at the price of coal, instead of treating coke purely as a bye-product, the demand for it would soon reach a point that would enable the desired reductions in the price of gas to be made. There is no need to fear as to the other bye-products. The output of sulphate of ammonia could be doubled without affecting the market; and a good tar looks after itself. It was high heats that ruined the tar market; and with the demand for tar increasing for road work, no flooding of the market need be feared.

During the last few years, the statement has several times been put forward that "as the gas manager's end and aim is gas, it is his duty to obtain the greatest volume of gas possible per ton of coal." With this I venture to disagree. The gas manager's duty is to obtain the greatest possible value per ton of coal; and until every industry dealing with coal recognizes that in this respect their aim is the same, little economy will be possible in our rapidly diminishing store of coal.

Domestic Coke Wanted.

The pressing of temperatures in carbonization to higher and higher degrees with the old conditions of lightly-charged retorts has given larger yields of gas; but it has loaded the gas with carbon bisulphide, depreciated the coke, and ruined the tar. One of the chief claims for the adoption of the full-charge horizontals and intermittent vertical retort for carbonization is that they have improved the character of both coke and tar. As I have shown, this is due to a certain proportion of the gas and tar vapour coming off through the cool core and so escaping over-cracking. But it can be only a partial improvement; while, as far as the coke goes, the nearer it approaches metallurgical coke the less it is fitted for a domestic fuel. True it is that where the coke has been made harder and brighter, the gas manager's market has improved; but it has been for use in furnaces, in manufacturing processes, and for producers that the increased demand has been felt, and not for domestic use.

Even for the heating of furnaces the coke made at extreme temperatures is not so good as when the heats were slightly lower. In Germany this is beginning to be recognized; and Mr. Körting, in a paper read this summer, points out that the inclined settings, which used to work with 12 per cent. of fuel, now require fully 16 per cent.—an increase partly due to higher temperatures but largely to more highly carbonized coke.

Already the strides forward which gas has made as a domestic fuel are telling the tale in our atmosphere. The yellow fogs of the last century are getting rarer; and if coke could be made a domestic fuel by leaving in it 6 to 8 per cent. of volatile matter, to facilitate ignition and give a flame, the gas-works of the country could command the fuel market. Remember that the sale of gas cannot be pushed beyond a certain point without overstocking with coke. The sale of both *pro ratâ* must be pushed; and if only gas men could be persuaded that this is the right road, they would be backed up by the smoke reformers and the public, and be able to sell a fuel coke at the price of the best coals.

I have shown that the factor for which most coke is ruined as a domestic fuel is about 3000 cubic feet of gas of the same value as blue water gas. The 3000 cubic feet left in the coke would be worth 4s. or 5s. a ton on the selling price. The cost of replacing this by water gas in the gas would be about 1s.; while the creation of a large domestic market would enable a reduction in the price of gas to be made that would still further increase its use as a fuel.

The Merits of the Settle-Padfield Retort.

Now I am sure in my own mind that these are the lines the gas industry should consider seriously, and that the advances in the next ten years must be an endeavour to get nearer to the ideal of carbonization and to improve both gas and coke; and having shown the object that I have in view, let me give my ideas as to how I think it may best be done. The modern forerunner of the vertical continuous process was, as I have already pointed out, the Settle-Padfield retort, which I tested at Exeter seven or eight years ago, with the principle of which I was immensely taken, and which gave splendid results. Its passage, however, from the experimental to the practical scale, as in so many cases, proved its undoing. On looking up a notebook of that date, I find that I obtained the following results:

Coal used, poor slack—No. 4 Cammerton.

Make per ton—	
Gas	13,250 cubic feet
Illuminating power .	14·72 candles (London argand)
Heating value . . .	533·7 B.Th.U.
Tar	None.
Same coal in horizontal retort—	
Gas	9862 cubic feet
Illuminating power .	15 candles

The Settle-Padfield process consisted of a semi-vertical or, if I may call it so, boot-shaped retort, much of the same design as now used in shale distillation. The vertical portion was about 6 feet in length, and the inclined part at the bottom 3 feet. The junction of the two portions was the weak part of the apparatus, as it was liable to crack; thus leading to infiltration of furnace gases, which was discovered when the gas given in the above test was analyzed. The leak was then made good; and further tests gave 13,000 to 13,200 cubic feet of 15-candle gas per ton. The outstanding feature of the process was that the upper 3 or 4 feet of the vertical portion of the retort were left empty, and that the coal was fed in at the top by a double plunger, in charges of from 2 to 7 lbs. per stroke, as desired, and fell through the empty heated zone on to the red-hot coke, where it was carbonized on the heated surface—the first rush of rich gas rising straight up through a zone of radiant heat to the mouthpiece at the top of the retort. The weakness in this process was that the coke was allowed to accumulate, and was then at intervals removed through an ordinary oven door at the bottom of the incline, so that the "baking area" varied according to the amount of coke at the bottom of the retort. Had the retort been a plain vertical one, with an automatic coke remover working *pro ratâ* with the coal feed, it would have been the perfect embodiment of the true conditions for carbonization, as the temperature needed only a little lowering in the superheating portion of the retort. The idea was to carbonize all the tar formed; so that if any condensed, it was returned to the retort. This phase of the subject is well worth discussion.

In the Settle-Padfield experimental retort, I should say, speaking from memory, that the temperature in no part of the retort was 1000° C., if as much; and yet at this temperature 13,000 cubic feet of gas per ton were made from Cammerton slack—the gas tested in the "London" argand giving 15 candles, which would be 17·5 candles on the No. 2 argand. The same coal in a horizontal retort gave 9802 cubic feet of the same candle power gas, and 10 gallons of tar per ton; so that the alteration in the method of carbonizing and the tar, which, if any formed, was returned to the retort, gave a gain of some 3000 cubic feet. The temperature of the lower portion, however, was insufficient to drive out all the more resistant volatile matter; and a very good coke was the result.

Now, what was it that caused this rattle-jack old retort to give results if anything better than the beautiful models of constructive skill that we see in the two present continuous systems? In the first place, we all know the importance of a large ratio of heating surface to the mass of coal. If one considers how the ground-up slack must have piled itself up on the top of the mass of red-hot material, heated from below, washed by the ascending hot gases from the last charge, and radiated upon by the sides of the red-hot retort above, it will be seen the heating surface was far greater than in any other system; and instead of heat slowly penetrating to it, it was plunged, the moment it left the feed, into a red-hot area, which drove off a good deal of gas before even it reached the carbonizing mass below, and deposited its sweating tar on the hot surface. The gases, as they were disengaged, rushed straight upwards to the exit, without contact with any surface to decompose them; the radiant heat being just sufficient to fix and get the best out of the tar vapour.

To many the idea of a heated space above the carbonizing coal seems like going back to the lightly-charged horizontal with the space that led to disaster. But they do not realize that radiant heat does little harm and much good, if there is not too much of it, and that it is contact with hot surfaces that is fatal. In the horizontal retort, the gases rushed-up to the top of the arch are decomposed by contact. In a vertical space, they rush to the cool top and exit pipe, hardly touching the sides; while the radiant heat performs such beneficent functions as breaking up the hexahydrides in the tar vapour into aromatic hydrocarbons and hydrogen. Mr. W. G. Africa, in a paper read last October at St. Louis [*ante*, p. 383], in relating his experiences with vertical retorts, says that they got unusually high results as to candle power by leaving a space of 4 feet of heated retort above the coal, thus fixing the vapours, which in full retorts do not reach the proper temperature for gasification.

A Perfect Continuous Carbonizing System.

Now, my idea of a perfect continuous system would be a vertical retort like the one that Glover first made, which had the space at the top, and fitted with a semi-intermittent feed and coke removal device, with the addition of the cooling chamber, with secondary air regeneration; the heat in the flues being concentrated on the outside of the retort at the spot where the coal falls on to the surface of the coke, as it is here that heat is withdrawn most rapidly. The temperature might then fade away above and below this

area to (say) 800° C.; and if properly regulated, 6 to 8 per cent. of the volatile matter of the poor gas-forming residues would be left in the coke to make a perfect domestic fuel—any shortage of gas being made up by blue water gas. The volume of gas actually made from the coal might be only 9500 to 10,000 cubic feet; but it would be rich in saturated hydrocarbons, and would probably stand dilution with 5000 cubic feet of water gas to bring it down to statutory requirements. In this way, it should be possible to make more gas than at present, and a valuable fuel; while we should have attained practically the ideal of carbonization—that is, uniformity.

Gasification of Tar and Tar Oils.

It has always been felt by the gas engineer that tar meant a great waste of vapourized carbon, which, if it could be kept in the gaseous form, would give an enormous addition to the gaseous products, and would represent a large proportion of heat and light. Experiment, however, has shown that the gasification of tar and tar oil is a most thankless task to undertake; and most gas engineers look upon it from the point of view taken by Mr. Lewis T. Wright—that tar is a child of high temperature, born in the heat of the retort, and so thoroughly acclimatized as to resist all further attempts to successfully gasify it. As regards the chief portions of high temperature tar-pitch, naphthalene, and the higher aromatic hydrocarbons—this is true. As we have seen, however, lowering the temperature of distillation increases the yield of tar; and it seems clear that a large proportion of it is due to primary action, and consists of paraffins, naphthenes, and other hydrocarbons, which would lend themselves to gasification, as well as oxygenated and "cycle" derivatives, which are more resistant, while naphthalene, anthracene, &c., are absent.

It is evidently worth while to see how far tar of this character can be gasified, and whether it is economically better to do this than to utilize it for other purposes. In the early eighties, Mr. Lewis T. Wright made a number of experiments on the gasification of tar and tar distillates by passing them into a retort filled with lime heated to 1100° C., and obtained the following results:—

Tar	10,700	cubic feet	per ton of	12·5-candle	power gas
Crude naphtha .	10,130	,,	,,	20·5	,, ,,
Up to . . .	27,000	,,	,,	14·5	,, ,,
Light oils . .	18,000	,,	,,	16·0	,, ,,
Up to . . .	30,000	,,	,,	13·5	,, ,,
Creosote oil . .	13,300	,,	,,	14·0	,, ,,
Up to	29,300	,,	,,	8·5	,, ,,

Now, tar in those days was tar, and not creosote oil, pitch, naphthalene, and free carbon; and yet on these figures it was decided that tar as a source of gas was "dear at a gift," owing to the ubiquitous naphthalene obstructions and troubles that followed any attempt at gasification. I have made many experiments upon this subject; and the conclusions to which I came long ago were that tar once obtained in the liquid state could be utilized for the purpose of gas making only in one of two ways:

1.—Distil off the naphthas, light oils, &c., which come over below 240° C. and gasify these.
2.—Inject the tar into a mass of incandescent coke, so as to break it up into hydrogen and methane, having a sufficient column of red-hot coke to filter off the deposited carbon.

If a ton of coal yields 20 gallons of 1·07 specific gravity tar, it is found that 25 per cent. of it will distil below 240° C.; leaving a residue perfect for road making. The 25 per cent. of distillate represents about 50 lbs. weight; and on gasification this will yield 10 cubic feet per pound of 15 to 16 candle power gas. Therefore by this method there is obtained an addition to the gas from a ton of coal of 500 cubic feet of good lighting and heating gas and 15 gallons of road-making tar. If, on the other hand, the tar be returned into incandescent coke, so as to entirely decompose it, the 20 gallons will yield 1500 to 2000 cubic feet of a mixture of hydrogen and methane with oxides of carbon, having a thermal value of between 400 and 450 B.Th.U. Taking the tar even of the quantity and quality yielded by such a process, no economy is to be found in converting it into gas by any other than the most simple expedients of the same character as the one utilized by Settle, of simply returning it to the retort. This applies to tar after it has been condensed, and not to nascent tar in the gaseous state as it leaves the decomposing coal.

At the beginning of the last century, when Clegg, Malam, and others had grasped the importance of preventing the degradation of the gases by contact with hot carbon, and were trying to avoid it by carbonizing in thin layers, it was commonly believed that if coal were distilled in layers less than 2 inches in thickness no tar was formed. This, of course, is nonsense, as anyone can see by heating a gramme of coal in the bottom of a test tube. But under the conditions of their experiments, none, or very little, came over; and the reason is the same that led to little or no tar being found in the Settle vertical retort.

In Clegg's rotary and web retorts, a thin layer of coal was passing in a tray or on a web through a flat oven heated to a high temperature, which gave an enormous ratio of radiant surface to the weight of coal carbonized. Under these conditions, the nascent tar vapours never had the chance of condensing into the vesicular form found in the brown tar vapour leaving the retort—it was superheated instead of being cooled, and bore the same relation to brown tar vapour that superheated steam does to the condensing steam we see leaving the spout of a kettle. Catch it in this nascent state and heat will gasify it; but if it once cools to brown vapour, molecular condensations prevent it ever again being got in the gaseous state without almost complete decomposition. Even in the Dinsmore process, with which Mr. Carr was so enamoured, not more than 1000 cubic feet per ton could be ascribed to its decomposition, as there was a fall in temperature before it entered the cracking duct or retort. The tar must pass direct from the coal into a temperature higher than that which gave it birth, but not hot enough to more than gasify it. If any really important results are to be obtained from tar as a gas producer, it will be on these lines, and carried out in a vertical retort, so that radiant heat alone acts and contact is reduced to a minimum. This is one reason for the importance I place upon having an empty space of constant dimensions at the top of a continuously working vertical retort. The economic advantage of gasifying tar is purely a question of the price it commands. Supposing the tar could be so gasified and yielded 120 cubic feet of 12 to 14 candle power gas per gallon, it would not be worth more than 10d. per 1000 cubic feet in the holder; so that unless the price of tar is under 1d. a gallon, it would not pay to use it for this purpose.

In comparing the gas-retort with the coke-oven for gas making, the outstanding difference is one of heating surface and of the size and condition of charge dealt with. In the gas-retort, it is less than a ton of a fairly dry mixture of all sizes; and the thickness of the layer carbonized does not exceed 12 inches (it is generally far less) and is not compressed. In the coke-oven, the charge may be anything up to 8 tons of damp, fine coal; and the thickness of the layer carbonized 16 to 30 inches—the charge being, as far as possible, compressed. The important point in furnace coke making is to provide a dense, hard coke, from which practically all volatile matter has been driven. This means that for the full temperature of carbonization (900° to 1000° C.) to reach the centre of the large mass of material, the time of carbonization becomes three to five times as long as in the gas-retort. Gas is evolved slowly, and therefore remains longer in contact with the red-hot coke; leakage is greater; and the net result is that the gas yield may be averaged at 9500 cubic feet of 10 to 12 candle power gas, with a heating value of 540 B.Th.U. So it is clear that as a method of carbonization for the production of gas, a coke-oven cannot compare with a retort—showing a shortage of 1500 to 2000 cubic feet of gas and 3 to 4 candles; while if, as in the usual practice, the poorer portion of the gas is used for firing the oven, the available gas amounts to only 4500 cubic feet of some 15-candle power.

Coke-Oven Gas and Town Supplies.

Now the greatest argument which I know in favour of coke-oven gas as a town supply is that it has been adopted largely in Germany and America; neither country being open to the reproach of want of commercial shrewdness. But are the conditions under which it has been adopted the same as those existing in (say) London and Brighton? Is it not a fact that its adoption has been for areas close to colliery districts, where the conversion of smudge and smalls into coke was a necessity—in districts rich in metallurgical works where foundry coke was a necessity? or in America where the general use of slow combustion stoves demands a hard slow-burning fuel? The claims of the coke-oven as a means of making town gas are based on the economies of carbonizing in bulk and the increase in yield and value of the coke, reducing the price of the gas as made into the holder to a fraction of the 10d. to 11d. per 1000 cubic feet it now costs. But if such a process were introduced in London, the make of coke would be enormously increased, and its quality of hardness and difficulty of burning would reduce, instead of increase, the demand for it for domestic purposes; coke prices would fall; and the economies would be converted into a heavy loss.

At the present moment, coke-oven gas is an impossibility for town supply, unless heavily benzolized, which is a mistake for a gas to be used with mantles; but under altered conditions of parliamentary requirements, it may well be that coke-oven gas will play an important part in lighting and power production in the North of England and other colliery districts. I cannot, however, conceive its ever being adopted where domestic fuel, and not foundry coke, is the chief requirement.

In a course of lectures such as these, four seems an ample allowance at the commencement—and probably to the audience more than ample at the end; but I realize only now how miserably inadequate the time has been for the expression of the matter I desired to bring before you, and can only hope that some of the points, controversial though they may be, will prove helpful in considering the carbonization of coal.

At the conclusion of this, the final, lecture,

Sir Henry Truman Wood (who presided) said those present would desire to tender to Professor Lewes their hearty thanks for the excellent course of Cantor Lectures he had just finished. He (Sir Henry) was not quite sure, but he believed Professor Lewes had given a larger number of these Cantor Lectures than anybody else. The present course of lectures had been well attended, and had brought there a number of experts in this particular subject; and they composed just the sort of audience any lecturer would desire. He hoped this would not be Professor Lewes's last course. There was only one point on which they

could disagree with the lecturer, and that was with his concluding remark as to there having been an inadequacy in his treatment of the subject. He had great pleasure in proposing a very hearty vote of thanks to Professor Lewes.

The proposition did not require a seconder—being immediately carried by enthusiastic applause.

Professor LEWES, in acknowledgment, said he thanked those present most heartily for this vote of thanks. He could assure them that one of his greatest pleasures in connection with the lectures had been to see in the audience so many of the junior gas men of London and around. To see, too, his old friend Mr. Edward Allen, of Liverpool, present, was also a great pleasure. He (Professor Lewes) agreed with Sir Henry that the audience he wanted was the audience that the Society of Arts wanted. He saw there that night an audience that supplied an excellent illustration—one that could not be better—of what was the original object of the Society of Arts in its foundation. To him it had been a sincere pleasure to meet those present.

RAILWAY STATION ILLUMINATION.

At the Meeting of the Illuminating Engineering Society last Tuesday—the CHAIRMAN (Mr. F. W. Goodenough) presiding—Mr. HAYDN T. HARRISON, M.Inst. E.E., read a paper on this subject. There were present a large number of engineers concerned with the lighting of railway premises.

The paper started by referring to the large differences which exist between the degree of artificial illumination in various railway stations. Of course, stations vary in importance, depending on the extent and class of traffic dealt with; but it is not an uncommon thing to come across two stations of equal importance in which the artificial illumination of one may be ten times that in the other. It naturally follows that either one is extravagantly lighted, or the other is not sufficiently illuminated. In many cases the standard of illumination has been raised; but, on the other hand, by far the majority of stations are still illuminated to the same low standard that existed ten or twenty years back. In the author's opinion, valuable work would be done if the Society could come to some conclusion as to the minimum illumination desirable for railway stations of various classes.

As the degree and system of artificial illumination of railway stations to a certain extent affects the safety of the public, it is surprising that the Board of Trade have never found it necessary to formulate regulations concerning it; but the author thinks this is accounted for by the fact that other operations necessarily carried out in stations make it essential that the minimum illumination should exceed that which might be called the danger-point as regards the public. It is unlikely, for instance, that people could fail to see the edge of a platform even with a degree of illumination as low as moonlight—say, 0·002 foot-candle; whereas he has come across few examples where the illumination is less than 0·01, though examples as low as these are numerous. In the case of passenger stations, the platforms are used for many purposes which require a comparatively high illumination much in excess of this—such as examining tickets, luggage labels, recognition of faces, inspection of time-tables, notices, &c., all of which operations have to be carried out rapidly and with precision, in order that time, which is so important a factor in railway work, shall not be lost.

The cost of artificial lighting has been much reduced during the last few years by the introduction of improvements both in gas and electric lamps; but it is surprising how little these improvements have been taken advantage of by railway companies. Station after station is still found lighted by means of flat-flame gas-burners or, at the best, upright mantles; whereas, the inverted mantle has numerous advantages for this class of work. With electric lamps, we still find the open-type arc lamp, of which the efficiency is very low compared to modern flame arc lamps, or even tungsten incandescent lamps suitably arranged. Therefore, even if capital had to be expended in making the necessary improvements, this would be soon wiped off by the saving effected, and the greatly improved illumination would be obtained without increased cost.

Mr. Roger Smith, whose knowledge and experience on this subject is unique, in a paper he has lately read before the Institution of Civil Engineers, gave it as his opinion that "the minimum illumination (midway between two lamps) 4 feet above a railway platform need never exceed 0·25 foot-candle; and the maximum under the lamp ought not to exceed 2 foot-candles, unless it is to appear poorly lit. It is partly for this reason that the value mentioned has been decided on." This opinion, emanating from the source it does, is extremely valuable; but it is a pity that Mr. Roger Smith did not give the other part of the reason for choosing this figure, because if 0·25 foot-candle is the lowest to which one can go before the appearance of a poorly lit station is reached, it is obvious a higher standard would be necessary for what might be considered a well-lighted station. Another point requiring careful consideration when dealing with this opinion is the height at which the illumination is taken, compared with the maximum illumination. For example, if a station platform were lighted with lamps 12 feet from the platform level, the candle power directly below the lamps must not exceed $2(12\cdot4)^2$, or 128-candle power, otherwise the lamps must be placed higher. The author agreed with Mr. Roger Smith in this respect, but pointed out that the same lamps, if placed 60 feet apart, would have to give over 400-candle power at 20 degrees from the horizontal—say, in order to obtain 0·25 foot-candle minimum. This profile of lighting is, of course, easy to obtain with some types of lamps, but impossible with others. For example, in the case of a station the author tested, lighted by high-pressure gas-lamps 80 to 90 feet apart and 13 feet to 14 feet high, the minimum illumination was 0·25 foot-candle, but the maximum 4 foot-candles—thus demonstrating that the type of lamps should have been placed higher; whereas another example, with tungsten electric lamps, in suitably designed lanterns between 14 and 15 feet high and 50 feet apart, gave 0·3 foot-candle minimum and 2 foot-candles maximum—thus being well within the limits laid down by Mr. Roger Smith.

It is, of course, possible to keep within the tenfold limit suggested with nearly any type of lamp, provided the height of the station roof will allow of the lamps being placed high enough; and in the case of termini and other large stations, this is generally possible. But in the case of large junctions and stations, where each platform is provided with its own roofing, this is, of course, impossible, and smaller light units placed close together must be used. This leads up to the relative efficiency of large or small units of light for the purpose of railway station illumination. Every railway station can be taken as an area occupied by platforms and rail bed. The former only need be illuminated, as any stray light reaching the permanent way sufficiently illuminates it.

The platforms are generally only in use when trains are standing at them; therefore, it is often customary to considerably reduce, if not altogether dispense with, the illumination when any platform is not in use. This, of course, can be done where each platform is treated separately; but if the station as a whole is lighted by means of very large units, it becomes difficult. Moreover, much of the light from large light units is wasted in lighting the permanent way, which is unnecessary. Therefore the use of light units giving more than a certain candle power is uneconomical in every respect.

Taking platform lighting as the illumination of a long, narrow area, and the degree of illumination at the edge of the area as being the most important, it follows that, if a centre row of lamps be used, the light from them must be such that the illumination derived from any one lamp must be sufficient to light the edge of the platform adjacent to it. It follows from this that the most economical arrangement of lamps would be that at which they are spaced at a distance apart equal to twice the width of the platform. Thus, in the case of a platform 30 feet wide, the lamps would be 60 feet apart, and to give a minimum horizontal illumination equal to 0·25 foot-candle 3 feet from the platform level would have to give 400-candle power at 20° if placed 13 feet high, taking the maximum illumination as 2 foot-candles. The height could be arranged to suit the vertical candle-power of the lamps there.

Effect of Height on Profile Curve of Lamp in Order to Produce 0·25 Foot-Candle Minimum and 2 Foot-Candles Maximum Horizontal Illumination 3 feet above Platform Level.

Height of Lamp above Platform.	Angle below Horizontal.	Candle Power.	Maximum Permissible Vertical Candle Power.
13 feet	18°	400	200
15 ,, ...	22°	295	290
20 ,, ...	30°	345	570

The above figures are taken for lamps arranged 60 feet apart.

The profile curves of lighting of various types of light sources are sufficiently well known to illuminating engineers to enable them easily to decide on the height of any type. For example, if low-pressure inverted gas-mantles were used, they would have to be erected between 15 and 20 feet above the platform level. The same would apply, of course, to the ordinary pattern of flame arc lamp. On the other hand, vertical incandescent gas-mantles or tungsten lamps could be placed as low as 13 feet from the platform level. It is not always possible to follow this rule of spacing, owing to constructional features of a railway station, supports, and other obstructions. These often necessitate that the lamps should be arranged at distances apart which result in the minimum of shadow; but in this case the author advocates quite a different system of lighting—viz., that the pillars or roof supports should be surrounded by the lamps themselves. This practice has not been generally adopted; it being more common to erect or suspend the lamps between the supports, which unfortunately results in the minimum illumination being halved in the shadow of the support. This shadow cannot be avoided where large units of light are used; but in nearly every case, it will be found more efficient to abandon the large units of light, and erect small units round the supports themselves, taking care to use efficient reflectors. This does away with all fixed shadows, and results in a higher minimum illumination efficiency.

In order to make a comparison between the relative illuminating value of high and low candle-power units, it is necessary to take a definite length of platform into consideration. Therefore, in the following table, this has been put at 1000 feet. The height of the lamps is stated as the height above the photometer screen, which

must therefore be added to the height mentioned, in order to calculate the height above the platform.

Total Candle Power Required to Obtain 0·25 Candle-Foot Minimum Horizontal Illumination, with Lamps of various Powers and Ratio of Same.

Index.	Distance Apart.	Height.	Angle F. Minimum Point.	Candle Power of Lamps.	Total C.P. per 1000 Feet.	Ratio.
A	20 feet	10 feet	45°	35	1,750	1
B	40 ,,	10 ,,	27°	138	3,450	2
C	50 ,,	10 ,,	22°	237	4,750	2·7
D	60 ,,	13 ,,	23°	400	6,666	3·9
E	80 ,,	15 ,,	20°	650	8,125	4·65
F	100 ,,	15 ,,	17°	1200	12,000	6·86
G	100 ,,	20 ,,	22°	1000	10,000	5·7
H	140 ,,	20 ,,	16°	2375	16,960	9·7
I	140 ,,	25 ,,	19°	2050	14,600	8·3
J	200 ,,	25 ,,	14°	5500	27,500	15·7
K	200 ,,	30 ,,	17°	4700	23,500	13·4

It naturally follows that the width of the platform which would be illuminated to the minimum extent is equal to half the distance between the lamps. Thus, in the case of A, for example, this would be 10 feet, or 5 feet either side of the line of lamps.

A general analysis of the above table goes to show that, when the distance apart of the lamps exceeds 60 feet, and it is intended to use high candle power lamps, these must be at least twice as efficient as the smaller units in order to obtain the same results at the same cost. For instance, supposing examples A, B, C, and D were carried out by means of low-pressure gas-mantles or tungsten electric lamps, and E, F, G, and H by high-pressure gas-mantles or flame arc lamps, the latter would have to be twice as efficient as the former to give the same results at the angles of light mentioned. But, on the other hand, if it were possible to utilize method B with the former, and G with the latter, the 1000-candle power lamps would need to be nearly three times as efficient as the 140-candle power incandescent lamps. Taking that, with gas, the high-pressure mantles give 60 candles per cubic foot against 20 to 30 for the low-pressure mantles, it is obvious the low-pressure mantles would be the more efficient system.

In the case of electric light, whereas with tungsten lamps and suitable reflectors it is possible to obtain 1·5 candles per watt at the angles mentioned with flame arc lamps, unless of very high candle power, 2 to 2·5 candles per watt at an angle of 17° is rarely exceeded. The use of flame arc lamps would not compare favourably with the tungsten lamps. On the other hand, 6 candles per watt can be obtained with the higher candle power lamps; but in order to get satisfactory results and keep the extremes of illumination within the prescribed limits, it would be necessary to use with these high-current lamps dioptric or similar light deflecting globes.

It must also be borne in mind that cost is not only affected by the consumption of gas or electricity, but also by the relative cost of renewals, labour, &c., which is considerably higher with high-pressure gas-lamps or electric flame arc lamps than is the case with low-pressure gas or tungsten electric lamps.

At various times the author has had the opportunity of making illumination tests at a large number of stations of varying importance, the results of which are interesting as indicating the condition prevailing at the present time. These results are set out in the following table :—

Test.	Class of Station.	Type of Lamps in Use.	Average Minimum Horizontal Illumination.
			Foot-Candles.
1	Large main line station	L.P. gas, upright mantles	0·015
2	,, ,, ,, ,,	H.P. gas	0·07
3	,, ,, ,, ,,	,, ,,	0·12
4	Main line terminus	,, ,,	0·2
5	,, ,, ,,	Flame arc lamps	0·5
6	,, ,, ,,	,,	0·25
7	,, ,, ,,	,, (special globes)	1·26
8	,, ,, ,,	Ordinary open arcs	0·08
9	,, ,, ,,	Tungsten lamps	1·25
10	,, ,, station	,, ,,	0·05
11	Main line large junction	Inverted gas	0·1
12	Suburban station (average)	Upright mantles	0·05
13	Underground tube stations	Enclosed arc lamps	0·24
14	,, ,, ,,	Tungsten lamps	0·38
15	,, ,, ,,	,, ,,	0·18
16	,, ,, ,,	,, ,,	0·28

It will be seen from these results that it is impossible to obtain any definite idea of railway engineers' requirements as to the minimum horizontal illumination. For example, the station mentioned under Test No. 1 deals with more traffic than that mentioned under Test No. 5. Example No. 7 is up to the standard mentioned by Mr. Roger Smith; and there is no doubt it is sufficiently lighted, but is gloomy compared with Station No. 5, where the higher minimum is gained by placing the lamps closer together.

The author next dealt with the lighting of goods yards, and commented on the general peculiar requirements of railway stations. Among the points, he said that local conditions, affecting, as they do, the degree of illumination necessary, make the task of fixing on any definite standard for the various classes of stations a difficult problem. Nevertheless, it emphasizes the fact that, if the degree of illumination was capable of being varied by the local officials to meet the exigencies of the moment, nearly perfect conditions would result, as the local officials are generally in a position to know the exact requirements at all hours of the night. Under these circumstances, the author suggests that, even in unimportant stations, a minimum of 0·25 foot-candle should be obtainable when all the light is turned on. This variation in the candle power should, if possible, be controlled from one point; and if the limits were arranged from 0·25 to 0·05 foot-candle, all requirements would be fulfilled at a low cost, provided the arrangements were such as to reduce the illumination in proportion to the electricity or gas used.

In reading a paper before the Society, the author remarked, one naturally avoids any invidious comparisons between the competitive illuminants; but, while on this subject of control of illumination, it is necessary to mention that in the case of gas-mantles it can, the author believes, only be effected at the cost of efficiency, unless, of course, the mantles are grouped in lanterns piped in such a way as to allow of the gas being turned off from mantles in each group; and even then the use of bye-passes often affects the saving adversely. In the case of electric lamps, it is easily accomplished without loss by running three wires instead of two. In the case of either illuminant it is not economical to turn out intermediate light sources, as the reduction of illumination is then out of all proportion to the reduction in cost.

Points from the Discussion.

Mr. J. S. Dow presented, on the screen, some measurements he had taken of the illumination at the tube stations, which stations showed the really keen activity that has been displayed in regard to methods of lighting. He pointed out that there was great variation in the conditions at the stations; and, in making measurements, one could not take into account everything a railway engineer had to consider. The figures indicated that the minimum allowance was nearly always above the 0·25 candle-foot that had been suggested as a minimum. The quantity of illumination that was now considered necessary by some railway engineers had grown twenty times greater since 1890. Regarding large and small units with arc lamps, the curves showed how the maximum illumination was piled up and how low the minimum. The most uniform system of illumination that was struck during these measurements was with small units. In connection with the lighting of the tube railways, the companies had aimed at greater spectacular effect outside; and the stations were now altogether different from the gloomy places that they used to be. Great strides were being made in this connection; and evidently there was an intention to subdue glare. He also took a few tests at Victoria Station; and the minimum illumination with the high-pressure gas-lamps there was a little over 0·2 foot-candle. This appeared to lend support as to what was considered to be the requirement for minimum illumination. Mr. J. G. Clark was present when these tests were made; and he could bear him out that this was the minimum illumination that it was intended to obtain there. Therefore photometrical tests bore out what theoretical considerations suggested.

Mr. Roger T. Smith (G.W.R.) said he should like to remind those present that the business of a railway company was to sell what Americans called "transportation." This had an effect upon the principle of lighting, because the illuminant used might depend very much on general policy rather than on the actual question as to what was the best illuminant to employ in individual cases. Supposing gas was 5s. 6d. per 1000 cubic feet, and electricity ½d. per unit, in an individual case, one would conclude that electricity ought to be used as the illuminant. But it did not follow. There might be questions of policy, as, for instance, the carriage of coal for a gas company, bearing on the consideration of the advantage of a particular illuminant in a particular station. To take another example, it might be right in a small generating station belonging to a railway company to deliberately increase the cost of coal from 0·33d. to 0·4d. per unit, because, in this way, they might get the traffic in coal that they might otherwise lose. This might be of vast importance compared with the saving possible in generating electricity. In another case, where there was a goods station worked electrically, the fact that they were obliged to have a supply of electricity there, and could therefore obtain lighting at a cheap power rate, might make it right to use the current for lighting, though gas was actually cheaper—simply because by this means cost was decreased all round. They could not always judge railway lighting on the individual merits of the case; it must be considered in relation to the general policy of a company as a whole. He said this because on this basis railway engineers were a little withdrawn by such considerations from the keen competition between illuminants. He was a little embarrassed about what the author had said as to his standard of illumination. The minimum of 0·25 foot-candle was right for a large terminal station where trains had to be in the station for a long time, and where a great deal of business had to be done. He thought, if such a high minimum were used all over a railway, that they would be really extravagant. On the one hand, they had their big terminal stations with (say) a minimum illumination of 0·25 foot-candle, and a diversity factor of about 8. On the other hand, they had a wayside station, which really needed what he thought Mr. A. P. Trotter had called "beacon" lighting. They only wanted occasional "spots" of lighting as Mr. Henry Fowler (M.R.) had put it, at the time when the station was being little

used. When the train arrived, this itself supplied enough illumination through the windows to light up the platforms. He was glad the subject of the proper minimum had been taken up; and he would suggest, quite tentatively, that for large terminal stations, 0·25 foot-candle was about right as a minimum; for intermediate stations, 0·15 foot-candle was right; and when they got to the small wayside stations, they really wanted nothing else but "beacon" lighting. Among the important points that Mr. Harrison had brought out, one of the most interesting was the employment of small units. In the use of small units, there was no doubt the prevention of glare might become somewhat difficult, because the lamps were lower down, and well within the line of sight. Coming back to the question of the minimum, in a reference to the figures in one of Mr. Harrison's tables, he said the 2 foot-candles that he saw in one place as a minimum was an extravagance railway companies could not bear. It must not be overlooked that railway companies were unlike almost any other company. The demands of the public went up, but a railway company could not increase their rates in accordance with the growth of expenses. Increased money could only be obtained by increased traffic. If the traffic did not come, the company were bound to lose. There was one question Mr. Harrison had not touched upon, and that was the illumination of the roof of a station. There were a great many railway stations in this country in which there was no illumination above the level of the lamps themselves. To his mind, to look up into a black mass above the lamps, was one of the most depressing things that could happen to anyone. He was sure it was worth while to spare quite a considerable amount of light to go up above the lamps to illuminate the roof. The moral effect of warmth upon oneself was so considerable that, if they compared stations which had their roofs faintly lighted and those which were perfectly black, there could be no question as to which was the correct thing to do. A good deal of excellent platform lighting was somewhat marred by the blackness above the lamps.

Mr. Frank Bailey (City of London Electric Lighting Company) said it had been his lot for many years past to have to do with the supply of light to railway stations; and he had never known a case where people had complained of too much light. One effect of good station lighting was that hand lamps by the officials on stations were rendered unnecessary. To his mind, however, it seemed a pity they should pin their faith to one definite maximum or minimum when they had such a large scope to deal with. At the same time, he should regard as imperative in all cases 0·25 foot-candle as a minimum. As to the treatment of stations, and the putting of lamps high up in the roofs, he had four stations all of which were structurally different; and it would be impossible to apply the same methods to them all. As a rule, a station roof was not always the prettiest spot imaginable; there were stations one could think of where no assistance could be obtained from the roof. However, the mere fact of placing a lamp high up should not bar one from placing smaller gas or electric units lower down. The subject should receive greater attention from the railway engineers of the country. If they made illumination their special province, it would improve their standing and position. Stations should be lighted so that it should be a pleasure to be in them at night time.

Mr. Burgess (M.R.) remarked that the standard suggested by Mr. Roger Smith was one which might be adopted at the larger stations. The previous night he took some hasty readings at a station fitted with high-pressure gas-lamps, 73 feet apart; and the maximum illumination was 2·75 foot-candles, and the minimum 0·4 foot-candle, which approached the suggested figures.

Mr. Herbert Jones (L.&S.W.R.) thought the point that Mr. Roger Smith had made in his paper before the Institution of Civil Engineers was that the maximum illumination on the platforms should never exceed the minimum on the train; otherwise the train would appear to be dull. In his opinion, the minimum on a train should be 1·5 foot-candles; and from observations he had made, he was of opinion that they should aim at 0·33 foot-candle as a minimum at important stations and 1·33 foot-candles as a maximum. This was 4 to 1; and so was a closer illumination ratio than was given by Mr. Roger Smith. At all stations local illumination was required at the barriers for the examination of tickets.

Mr. A. P. Trotter said it appeared there were two methods to be adopted in railway lighting; and possibly if these were mixed, there would be a loss of efficiency. One method was high lamps to give general illumination; the other small unit lighting to deal with platform by platform. The tube stations were excellently lighted; but in ordinary stations he presumed they did not want to light the rails. For platform lighting, he thought the proposal that Mr. Harrison made of small lamps placed fairly low down, and plenty of them, would be the most economical. If there was a departure from this, it seemed to him it would be better to put larger lamps high up, and so illuminate the whole station. But they must be careful to have the lamps so situated as not to throw heavy shadows from the trains upon the platforms. With high-power lamps, there should also be local lights to enable the time-tables to be consulted.

Mr. Grove (Central London Railway) spoke approvingly of the use of Holophane reflectors, and of the necessity of good lighting for the mural advertisements, which brought in a large revenue.

Mr. John Severs (G.N. and City R.) spoke of the change from arc lighting to tungsten lamps at stations under his charge.

Mr. J. G. Clark (Gaslight and Coke Company) observed that really the only point that occurred to him at the moment was a comparison of a station lighted by upright and inverted gas-lamps. Mr. Dow had given them an illumination measurement of the lighting of Victoria Station by inverted Keith lamps. It so happened that some two or three years ago he made some observations at the same station when it was lighted by upright incandescent burners—high-pressure gas at 54 inches in each case. It was interesting to note that, both in regard to maximum and minimum, the illumination was the same in the two instances; but there was a great saving in gas due to the use of the inverted burners. The saving of gas was some 40 to 50 per cent.; while the illumination was identical. The only other point was as to whether the minimum illumination on platforms should be higher or lower than the illumination in the carriages. It seemed to him the platform should be rather brighter than the carriages. When a passenger got out of a train, it was then that he required more illumination.

The Chairman agreed with Mr. Harrison that small units were really advantageous from the point of view of economy—that was to say, small units placed reasonably near the ground, as well as reasonably near together. The standard of 0·25 foot-candle as a minimum was one that all suppliers of illumination would like to see applied for all stations; but it was probably too high for out-of-the-way stations. From personal experience, he knew it was considerably above what would be found at some country stations. In his opinion, Mr. Harrison had done good service to the travelling public in calling attention to this subject. It was important and gratifying to know that railway engineers were generally paying more attention to illumination as a science than they used to do. Good lighting was an economy in railway station work, just as it was in workshops. Work was done more quickly, and there was less waste, if everybody had light enough to work by; and in many instances light was a good advertisement.

Mr. Harrison, in the course of his reply, pointed out that on the tube railways, the stations were more confined than ordinary stations; they had a considerable amount of reflection; and they had cheap power. These three factors had to be borne in mind in making comparisons. The high illumination the public were getting in the tubes would make them want it elsewhere. In his opinion, there was no reason why all stations should not have 0·25 foot-candle as a minimum illumination while a train was in the station; and then, when the train had gone, the station could again go to sleep. He was in favour of Mr. Bailey's suggestion for lighting the roofs with high-power lamps, and having lower-hung smaller units for special lighting.

ESCAPE OF GAS FROM COAL.

Some time ago, an investigation was undertaken by the United States Geological Survey into the rate of escape of gas from several coals while kept in bottles connected to gas-collecting reservoirs. The researches are being continued by the Bureau of Mines at the experimental station at Pittsburg; and a report on the subject has lately been made by Messrs. H. C. Porter and F. K. Ovitz. It appears in the form of a technical paper published by the Bureau and abstracted in the "Colliery Guardian," and furnishes the following particulars.

Gas escapes from coal not only during the breaking-down of the coal in the mines, but also continuously for a long time after the coal is mined. During the first two weeks after mining, there was set free by one coal, exclusive of the gas that escaped during mining, a volume of methane equal to three-fourths of the volume of the coal itself. Probably each cubic foot of this coal (in the seam) set free in all during its mining and during the first two weeks thereafter a cubic foot of methane. It was shown by a further test that during the first five months after mining there was set free from this coal a volume of methane equal to one-and-three-quarter times the volume of the coal. The experiments described in the paper bring out the fact that methane and small quantities of carbon dioxide escape from coal for an extended period under atmospheric pressure; the amount of the gas and its rate of escape being nearly the same as when the coal is kept in a vacuum. Furthermore, oxygen is absorbed rapidly by fresh coal, and in quantities far out of proportion to the carbon dioxide liberated, if the latter be assumed to arise from combustion of the coal.

Unfortunately, the results do not permit even an approximate estimate of the rate at which the different coals absorb oxygen. It was found late in the course of the experiments that the concentration of the oxygen available for action on the coal had much influence on the rapidity of the action; and this concentration varied decidedly in the different tests. Ordinary air was used in some of the tests, and oxygen, 95 per cent. pure, in others. In all the experiments there is clearly shown, however, a rapid and long-continued absorption of oxygen, with little or no accompanying formation of carbon dioxide. Later experiments, now in progress in the laboratory of the Bureau of Mines, show that coals vary widely in the rapidity with which they absorb oxygen under like conditions.

The rapid absorption of oxygen by fresh coal without the formation of carbon dioxide is well illustrated by a coal from Connellsville (Pa.). A sample of 10 kilos. (22 lbs.) of this coal absorbed during the first day after mining nearly half the oxygen in the

10 litres of air in the bottle, and gave off little more than a tenth as much carbon dioxide as would have been formed if all the oxygen absorbed had combined with carbon to produce carbon dioxide. The oxygen absorbed from air by coal probably does not form directly either carbon dioxide or water, but is merely added, as suggested by Boudouard and others, to certain compounds in the coal that are unsaturated with respect to oxygen, and thereby produces humic acid or related substances.

The results presented show large variations in the quantities of methane liberated by the coals tested. A Kentucky cannel yielded only a trace of methane in nine months; while the Harrisburg (Ill.) coal gave off one-fourth of its volume in four days, and the Monongah (W. Va.) coal one-third of its volume in the same time. These results are by no means to be interpreted as showing that some coals which yield little or no gas after mining are therefore not accompanied by gas in the mines. Pocahontas coal, for example, yields little methane after mining; but the mines in the western part of what is known as the Pocahontas district contain at times large quantities of gas. The methane which accumulates in coal mines may come from two sources—from reservoirs of gas under pressure in the rock strata, and from the coal bed itself, either from cavities where the gas has accumulated, or from a state of condensation or compression in the microscopic pores of the coal. The investigation discussed in the paper has to do only with the latter source; and though it advances data which emphasize the importance of the coal seam itself as a source of gas, it in no sense overlooks or lessens the importance of the inflow of gas from outside reservoirs.

It is known that variations in atmospheric pressure have an influence on the accumulation of methane in mines. Apparently incompatible with this fact are the results presented in the paper, which show that methane escapes from broken coal at a rate practically unaffected by large reduction in pressure. Atmospheric conditions, however, may easily affect the escape of gas from the bed of coal *in situ*, since a slight fall in barometric pressure may open communication with cavities or crevices in the coal bed where gas is imprisoned under pressure, though the same decrease of pressure may have little or no effect on the gas that is more intimately imprisoned in the pores of the solid coal.

Carbon dioxide was found in the gases evolved by all the coals that were tested. The amount varied decidedly for the different coals; the maximum was 0·36 volume in seven months. The largest volume of combustible gas evolved was from the sample of Benton (Ill.) coal. From 12·2 kilos. of this coal, 16·9 litres of methane were evolved in one year and five months. If a calorific value for methane of 9400 small calories per litre is assumed, there were lost by the 12·2 kilos. of coal $9400 \times 16{\cdot}9 = 158{,}860$ calories. As the heating value of the coal was about 7500 calories, the percentage of loss was approximately

$$158{,}860 \div (12{,}200 \times 7500) = 0{\cdot}16 \text{ per cent.}$$

It is evident, therefore, that no considerable loss of heating value can be attributed directly to the escape of combustible gases from coal during storage at ordinary temperatures.

The results of the experiments discussed show, the authors say, that certain American coals, the mining of which is attended with danger from accumulations of inflammable gas, liberate this gas not only while they are being broken down in mining, but also during a long period thereafter. At first the gas escapes rapidly, but the rate diminishes, and tends toward a final cessation in from three to eighteen months. If the volume of the small lumps of coal used in the experiments be taken as the unit of measurement, about one-quarter volume of methane escapes during the crushing of the coal, and one-half to one-and-a-half volumes on continued exposure to the air. The loss of fuel value by this loss of gas is small; but the danger of accumulation of explosive gas from this source in mines and in coal bunkers is sufficient to justify its being taken into account in the ventilation of mines and in the storage of coal.

Birmingham Gas Department Magazine.—We have received a copy of the first number of this magazine, the intended publication of which was announced in the "JOURNAL" a few weeks ago. It has as a frontispiece a portrait of Alderman Sir Hallewell Rogers, J.P., the Chairman of the Gas Committee, who expresses good wishes for the success of the magazine in a short address which occupies the first page. The publication is the outcome of a suggestion that a gas undertaking such as that of Birmingham, employing nearly 3000 people, should have a monthly magazine "to chronicle the doings, whether at work or play, of the various sections of the little community." The suggestion has been fairly well carried out. There is a description of the Saltley works by Mr. F. J. Bywater, who has lately been appointed to succeed Mr. Tysoe at East Greenwich; and some particulars of his career (accompanied by a portrait) are given. Another portrait is that of Mr. W. S. Smart, who, as readers may remember, has left Saltley to become the General Manager to Messrs. W. J. Jenkins and Co., of Retford. A commencement is made with a series of articles on "The Evolution of Light;" and the other contents are varied. Two plates—one of the football team of the Birmingham Gas Recreation Athletic Club, and the other of a humorous character—accompany the number, which altogether is a very creditable production. The Chairman of the Editorial Committee is Mr. R. S. Hilton; and the Editor is Mr. E. W. Smith, of the High-Pressure Gas Laboratory of the Corporation. The price of the magazine, which consists of 16 quarto pages in a wrapper, is 2d.

WATER PAPERS READ AT THE GERMAN ASSOCIATION MEETING.

It was mentioned in the report of the proceedings at the general meeting of the German Association of Gas and Water Engineers, held at Dresden on the 26th to 30th of June last, that a number of papers dealing with water supply were read on the second day of the meeting [see "JOURNAL," Vol. CXV., p. 27]. Some of these papers were of exceptional interest; and the following is a brief summary of their contents.

The first paper, by Herr Herzberg, of Berlin, on "The Work of the Association for Water Supply and Sewage Disposal," was sufficiently noticed in the report already referred to. The second paper, by Geheimrat Dr. Gärtner, a Professor at Jena, was on

Present Position of the Question of Water Supply.

The author said that at first the question with most towns was to obtain the water required as cheaply as possible, and its quality was regarded as of little importance; but epidemics which occurred about the middle of the last century caused a change of view. At first, water was generally regarded as a disseminator of sickness, and in Germany Pettenkofer was almost the only opponent of this view. The work of Pasteur and Koch had demonstrated, however, the great importance of the quality of drinking water, and substantiated the popular view of the part which water could play as a disseminator of illness. It was proved that the transmission of illness by water was not only possible, but actually occurred in many cases—the disease germs were present in the water. The problem for water-works people was to combat the admission of germs to the water, or to effect their removal from it. The empirical requirement that were initiated by Koch, that the water should not contain more than 100 bacilli per cubic centimetre (1638 bacilli per cubic inch), met at first with much opposition, but subsequently proved to be well founded, and was at the present time generally complied with. The contamination of underground water commonly occurred from the surface, and the protection of the surface layer ought not to be neglected. It was better to arrange protected zones, which with underground water need not be very large. With spring water, which had to be sharply distinguished from underground water, both from the hygienic-bacteriological, as well as the geological, standpoint, it was otherwise. The underground water had undergone filtration; the spring water could easily be contaminated. Soft water was not harmful as had been frequently supposed. The production of artificial underground water had lately been quite properly taken up again. Naturally filtered river water was also much used; the purification in this case taking place by horizontal filtration, for which material with fine pores was most trustworthy, though it easily became clogged. There were installations for the production of artificial underground water at Frankfort-on-the-Maine and Gothenburg. At the latter place, there was first a preliminary purification, and then the water passed through the wells. Filtration downwards appeared better, but presented difficulties. Large natural areas which were not otherwise utilized must be intermittently flooded, but the grass must not be soaked by too prolonged flooding. Water from valleys which had been dammed was quite good in certain conditions—that is, it must be old, and therefore the basin must be sufficiently large, and streams flowing in from the side must enter at the upper end. Filtration was not always requisite, and need be only bacteriological.

Slow filtration was general in Germany; but in many cases preliminary partial filtration was practised—as by the use of the Puech filter at Magdeburg, Borchardt's filter cloths at Remcheid, and Götze's double filter at Bremen. In many instances sedimentation, by which the number of bacteria was reduced, took the place of preliminary filtration. By means of it, 80 per cent. of the bacteria could be removed in eight days. Sedimentation could be effected by sulphate of alumina; and recently chloride of lime had been again recommended for the purpose. An excess of the latter must be used, which had to be got rid of. The reduction in the number of bacteria by it might reach 95 to 98 per cent. Purification by chloride of lime might, in case of need, be employed to supplement filtration. Rapid filtration was common in North America, and, while elsewhere good results appeared to have been obtained with it, more trials were requisite. The sterilization of water by means of ozone and ultra-violet rays had come to the front of late years. Cloudy water was cleared by ozonizing, and the bacteriological effect was as good as with sand-filters, but appeared not to be so trustworthy. Small ozonizing apparatus was still unreliable. The sterilization by means of ultra-violet rays was applicable to a clear colourless water free from colloids, and in that case its action was quite reliable. For purification at central works, the process appeared still to be too dear; but it should be very useful in epidemics. Small filters had hitherto developed but little. The removal of iron might be accomplished satisfactorily in either open or closed apparatus. Formerly 0·03 part of iron per 100,000 was regarded as permissible; but in recent installations an upper limit of 0·01 part per 100,000 had been recommended. Large plants with slow filtration were needed, and manganese was then also removed. For the humic acid salt of manganese a precipitating medium was naturally essential. Water might take up iron again, but this could be avoided by

removing the carbonic acid from it. Durable coatings for inside the pipes prevented iron being taken up.

In the discussion on the paper, Sir William H. Lindley observed that the limit of 100 bacilli per cubic centimetre should not be taken as a law; the nature of the bacilli should also be taken into account. In some circumstances, water containing a greater number of bacilli was quite harmless. The distinction between underground and well water was not altogether possible. The danger of horizontal filtration in the neighbourhood of streams was not very great, as the strata were not regular. Rapid filtration was much used in Russia, but slow filtration was preferable. Good storage and slow filtration were simple and trustworthy, but in special cases other methods might be employed.

Professor Bujwid, of Cracow, said that while there was truth in the views of both the lecturer and Sir William H. Lindley, as to the limit of 100 bacilli per cubic centimetre, it afforded a practical rule which, as a matter of fact, had answered well.

Herr von Feilitzsch, of Brunswick, recommended slow filtration in conjunction with the removal of iron, as then carbonic acid was removed at the same time.

Herr Debusmann, of Breslau, described the surface irrigation with intermittent working which is being tried in the town. The underground water was purified by means of sulphate of alumina, and by slow sand filtration was also very satisfactorily purified from iron and manganese. The trials were not yet concluded.

Herr Anklam, of Berlin, expressed a wish that investigations should be made on the rusting of mains, and pointed out that, in any case, excess of oxygen was to be avoided when a process for the removal of iron was in use.

In his reply to the discussion, Professor Gärtner observed that an upper limit of 100 bacilli per cubic centimetre must be regarded as satisfactory on practical grounds. It appeared to him desirable to maintain the distinction between underground water and spring water; the crucial point being whether the water had passed through a finely-porous material or not.

Production of Artificial Underground Water from River Water.

A paper on this subject was next read by Herr Scheelhaase, of Frankfort-on-the-Maine. The author said that the provision of unobjectionable water was constantly becoming more difficult and more costly. If it was not desired to depend on the filtration of surface water for the future, means must be found for dealng with river water so that it became equal in every respect to natural underground water. The methods hitherto applied with this object were not quite suitable. The author had made it his aim to introduce a process which imitated the phenomena by which underground water was produced in Nature—viz., the systematic infiltration of river water into the sources of underground water at a considerable depth. A prolonged trial for putting this idea to the test had been carried out at the Stadtwald water-works for the supply of underground water to Frankfort. This trial had been started with the assistance of the Municipal authorities three years ago, and might now be regarded as finished. The water from the River Maine was first passed through artificial filtering plant, which removed from it floating impurities which otherwise would block the natural layers of sand. The water passed into the strata of sand through a drainage pipe about 160 feet in length, laid horizontally at a depth of 10 feet below the surface of the ground. The natural level of the underground water was about 43 feet below this pipe. The water took fourteen days to penetrate to the natural underground water. During this time the underground air effected the transformation of impurities of the river water; and the improvement in the water in this period was very remarkable. The water then flowed on, gradually mixing with the underground water, to the pumping plant. After passing through about 65 feet, the water was found to be free from organisms. After about 250 feet, the temperature had become uniform; and after 330 feet, the water had lost the characteristic colour of Maine water. The experiments had thus shown that it was possible from dirty river water to produce artificial water which was equal in quality to natural underground water.

At the conclusion of the reading of the paper, Professor Gärtner observed that the mouldy flavour which frequently occurred with such water could be removed by means of ferrochlor.

Modern Pumping-Engines for Water-Works.

A lecture by Herr R. Schröder, of Hamburg, described, with the aid of pictures thrown on the screen, types of modern pumping plant for water-works. The author referred to the turbo-pumps at Düsseldorf, Dortmund, Beelitzhof, near Charlottenburg, and other places, and then to pumps driven by suction producer gas, oil-engines, and steam, and compared the working costs per hour for fuel, depreciation, and interest on the engines apart from boilers, buildings, &c., for working periods of from 1 to 24 hours. It was not easy, however, he indicated, to give one or other type general preference, as special local conditions would greatly affect the choice. At the present time, however, the Diesel engine working with tar oil, or better still with tar, appeared to be the most economical motor for water-works, especially if it were possible to couple it direct with the pumps.

Sterilization of Drinking Water by Ultra-Violet Rays.

The next paper presented was by Professor Courmont, of Lyons, who unfortunately was unable to read it in person. Another paper by Professor O. Bujwid, of Cracow, entitled "The Action of Ultra-Violet Rays on Bacteria" was read, and discussed along with Professor Courmont's paper.

Professor Courmont stated in his paper that the destructive power of sunlight on bacteria depended on the ultra-violet rays. The greater part of these rays were however, absorbed by the atmosphere; and in order to make practical use of this property of them, they must be obtained from artificial sources. He proceeded to enumerate these sources, starting with the quartz glass mercury vapour lamp, which he described as the most powerful apparatus for the production of ultra-violet rays. Quartz allowed the ultra-violet rays which predominated in the spectrum of mercury to pass through it. The quartz mercury lamp, which was so destructive to bacteria, was dangerous to living tissue, and persons who exposed themselves directly to its rays were liable to injury. The quartz mercury vapour lamp worked with continuous current and must always be kept cool. In favourable conditions, its life was theoretically everlasting, and in practice was extremely long.

The most important use of the property of the rays of this lamp of killing bacteria lay in the sterilization of drinking water. The author, in conjunction with M. Nogier, had worked out a process for applying the ultra-violet rays of the lamp to the purification of water. It was shown, in the first place, that water was permeable to a depth of at least 12 inches from the lamp by the ultra-violet rays. It had been further shown that within this zone the micro-organisms of a highly impure water were very rapidly destroyed. An experimental plant, consisting of lamps 6 inches to 12 inches in length, placed in a vessel containing about 24 gallons of water, were first used. A great number of trials had been made with this apparatus; and as they showed that highly impure water was completely sterilized by it quickly, M. Nogier subsequently constructed a number of types of apparatus for use in institutions, &c., for the sterilization of water supplies. It was found that liquids rich in colloids—such as wine, beer, bouillon, &c.—very rapidly absorbed the ultra-violet rays, which therefore only permeated them to a distance of a few millimetres. Consequently, such liquids were not sterilized by the rays, unless they were treated in very thin layers, or the whole of their molecules were brought into actual contact with the lamp. Sterilization in these cases would, however, be too costly. Further, cloudy water could not be satisfactorily sterilized; and hence water which was not clear must be filtered before it was exposed to the action of ultra-violet light for sterilization.

Given clear water, it might be completely sterilized by means of ultra-violet rays even though it contained many more bacilli than any natural waters. Water which would be regarded as very impure rarely contained more than 1000 *bacterium coli* bacilli per litre, and experiments had shown that water containing over 1,000,000,000 such bacilli could be completely sterilized by the ultra-violet rays. Typical results of the passing of impure water through the experimental apparatus were tabulated in the paper. From the results, the author concluded that the sterilizing power of the ultra-violet rays from a quartz mercury vapour lamp immersed in water was so great that the problem of the complete, rapid, and economical sterilization of clear water must be regarded as solved by this process.

It was preferable to immerse the lamp in water because its sterilizing action was in this way better utilized, while at the same time the working life of the lamp was much prolonged. The ultra-violet rays directly killed the micro-organisms of the water. It had been shown by the author and MM. Nogier and Rochaix that the sterilization did not depend on the action of ozone, because no trace of ozone was formed in the time—viz., a few seconds to one minute—necessary to effect sterilization. The formation of ozone by ultra-violet rays was only a laboratory experiment. Sterilization might take place in the absence of oxygen. Neither was hydrogen peroxide formed by the rays. The water itself was only slightly affected by the ultra-violet rays in the short time during which they had to be applied. The organic constituents—viz., ammonia, nitrites, nitrates, and other dissolved substances—were for the most part completely unaffected by an exposure of ten minutes to the rays. The taste and smell of the water were not affected at all. Experiments had shown that the water treated by ultra-violet rays was without any ill-effects on persons drinking it. The question of whether the toxins of the bacilli in the water were destroyed by the ultra-violet rays had been investigated; and it had been found that they were destroyed in a few minutes in a sufficiently dilute aqueous solution, and were even diminished in a richly colloidal substance such as filtered bouillon. The primary condition for the application of ultra-violet rays for the effective sterilization of water was the permeability or translucency of the water. A cloudy water must be first of all filtered. Apparatus had been constructed for three different uses—viz., (1) small apparatus for the sterilization of the water supplied to separate dwellings; (2) apparatus of larger capacity for institutions and small communities; and (3) apparatus for the sterilization of town water supplies in which several thousand tons of water had to be purified per hour. Of the third class, two plants were now being tested—one in Marseilles, where, however, the lamp was not immersed in the water to be sterilized. This plant had a capacity of 44,020 gallons per diem. The other was at Choisy-le-Roy, where the lamps were immersed in the water, and the capacity of the plant was 440,200 to 660,300 gallons per diem. The micro-organisms were reduced by over 99 per cent., and the results were very satisfactory in this case, while the process was economical owing to the small space and small staff required.

Professor Bujwid's paper referred to the same method of sterilizing water; and he pointed out that it was possible by his

method to sterilize completely water containing 10 to 50 million cholera or typhus bacilli in 1 c.c. The method thus afforded an especially valuable means of combating epidemics. He observed that towns which were dependent for their water supply on a clear but infected river water could apply this process for its sterilization. In regard to the consumption of current, a small household apparatus dealt with from 1760 to 3280 gallons in 24 hours, with a consumption of 6 ampères at 30 volts.

Professor Gärtner, of Jena, in opening the discussion on the two papers, said that he had been working with ultra-violet rays for some time past, and was of opinion that they were a very valuable agent for the sterilization of water. Their activity did not depend on the formation of ozone or hydrogen peroxide. The bacteria were destroyed by the direct action of the light. It was essential that the water should be clear, colourless, and free from colloids. This limitation restricted the application of the process on a large scale, as plant for preliminary clarification would be required. The Westinghouse apparatus also worked well. In times of epidemic, clear water—such as that of St. Petersburg, or of the Lake of Geneva—could be straightway sterilized by the process. The lamps were unfortunately somewhat fragile; but the process was not so tedious as the ozonizing process.

Sir W. H. Lindley said that the consumption of energy per thousand gallons of water did not appear to be very great. Water engineers, however, attached great value to a process being applicable on the large scale, as decentralization of water purification rendered it costly, troublesome, and impracticable on personal grounds, while encouraging carelessness at the water-works.

Herr Reese, of Dortmund, also thought that central purification of water was preferable. It appeared to him, however, that, from what had been disclosed so far, the ozone process was cheaper than that described by the authors.

Herr Peter, of Zürich, referred to the conditions in Marseilles, where formerly a very bad water had been distributed, which had to be purified in domestic filters. Now water purified at the central works had to be distributed; and it was treated by a preliminary stage filtration and then sterilized by ultra-violet rays. The experimental plant, with a constant output of 22,010,000 gallons per diem, consumed 450 to 500 kilowatts. The filtering plant was smaller than that for other methods, as the rate of flow could be about treble. These figures allowed of a comparison of cost being made.

Herr Kordt, of Dusseldorf, said that the process appeared to him to be applicable in cases of necessity where boiling of the water would otherwise be recommended, but in general central purification of the water was preferable.

Committee on the Working of Water-Works.

The proceedings relating to water supply at the meeting of the Association concluded with the presentation of the report of the Technical Committee of the Association on the Working of Water-Works, by the Chairman, Herr Reese, of Dortmund. The report stated that the Committee had held a meeting in Berlin in December, 1910, when the chief subject of discussion was the preparation of the material for the twenty-first volume of water statistics, and the issue of questions for the data required for the twenty-second volume. It was reported that the twenty-first volume of statistics would include the working results of 416 water undertakings, as compared with 381 in the previous volume. The dates to which the statistics referred differed considerably for the different works, because the authorities of some undertakings replied very tardily to the request for information. The question of bringing the information contained in a single issue of statistics more into line in respect of the working period to which they referred for the different undertakings, was discussed; and a scheme by which it was hoped, with the assistance of the authorities of the undertakings, to collect and publish the statistics more promptly, was drawn up for report to the general meeting. At the meeting of the Committee, Herr Schröder, of Hamburg, attended by invitation, and undertook to prepare a paper on the latest pumping machinery for water-works for communication to the annual meeting [*vide supra*]. The report stated that the Association, through the Chairman of the Water Committee, and other members, had taken an active part in supplying data and plans for display in the water supply section of the International Exhibition of Hygiene at Dresden.

THE NEW WATER-WORKS FOR SKEGNESS.

By Percy Griffith, M.Inst.C.E., F.G.S.

[Extracts from a Paper Presented at the Meeting of the Institution of Water Engineers, Dec. 9.]

The works which are the subject of this paper were undertaken by the Right Honourable the Earl of Scarbrough, C.B., to whom the recent rapid development (if not the very existence) of this popular seaside resort is exclusively due. The author was called in to advise upon the question of water supply in the year 1904; and, after assisting as Consulting Engineer in the promotion of the Skegness Water Act, 1905, he designed and carried out the scheme of which he in the paper describes some of the more interesting features.

Having given particulars of the existing works, the author said, with the evidence found available, he selected a site at Welton for the trial boring; and he sees no reason to regret his choice. The boring was carried out with 10-inch tubes to a depth of 50 feet from the surface; and 8-inch diameter tubes were afterwards driven to a depth of 186 feet from the surface. Below this the boring was continued with a 6½-inch cylindrical tool (working in loose shot) to a depth of 252 feet from the surface, which penetrated the Kimmeridge clay for a depth of 20 feet. It was subsequently suggested that the continuation of the boring into the clay was a mistake, and that the trouble which was caused by argillaceous sand was due to this. But the author is satisfied that this was not the case; on the contrary, he considers the lower part of the boring was useful not only in definitely identifying the Kimmeridge clay, but also in retaining a proportion of the infall out of contact with the inflowing water.

On reaching the depth mentioned, the flow of water at the surface was found to be 4320 gallons per hour. A test with air-lift plant produced a gradually increasing yield, which ultimately reached a maximum of 30,000 gallons per hour, with an average pumping-level not exceeding 40 feet below the surface; and, allowing for uncertainties and contingencies inseparable from borings of this nature, it was calculated that a fairly constant yield of 20,000 gallons per hour might be obtained. From the results obtained with the permanent pumps, the yield at a depth of 35 feet below the surface was proved to be 18,000 gallons per hour. Of course, a proportionately increased yield can be obtained by deepening the well and lowering the pumps.

The flow from the boring having been proved satisfactory both as regards quantity and quality, it was decided to rely upon the trial boring as a permanent source of supply, and to sink a well around the upper part of the 8-inch tubes, to take the pump suction. This well was carried to a depth of 43 feet below the surface, and was lined partly with brick in cement and partly with cast-iron cylinders. In consequence of settlement which took place during the sinking, the well was, on its completion, eccentric to the boring; but this was found to be an advantage in dealing with the sand, as it permitted of the pump suctions being isolated from the bore-tube inlet by means of a sand-screen, and the bore-tube side of the screen was also in this way kept clear of obstruction, so that it could be "shelled" from the surface. The top of the well was opened out into a rectangular pump chamber 10 ft. 6 in. deep, which gave ready access to all the working parts of the pumps.

The pumping machinery was in duplicate throughout, and comprised Crossley suction-gas plant, Crossley gas-engine, and Hayward Tyler's three-throw plunger pumps. The head-gear consisted of a belt-driven fast-and-loose pulley worked from the engine, and cast-iron pinion working into a mortice spur-wheel on the pump crank-shaft. The speed was thus reduced from 175 revolutions per minute at the engine to 37 revolutions per minute at the pumps, which had a capacity at this speed of 18,400 gallons per hour. The working head on the pumps was found to be 210 feet, including "suction head" and friction in the rising main. The whole of the plant gave complete satisfaction in working, and the "guaranteed duty" (expressed in the form of a maximum fuel consumption of 1·60 lbs. of anthracite nuts per 2,000,000 foot-pounds of work done measured in water lifted) was considerably improved upon in the official test, even when the pump-valves were much scored by sand. Had the pump-valves been renewed before the test, much better result would have been obtained. This test revealed a net fuel cost of 0·12d. per 1000 gallons lifted 100 feet. The author does not claim an official test of this nature as a reliable guide to the normal working efficiency of any plant; and he has therefore obtained from Mr. Ralph Hudson, the Urban District Council's Engineer, a report upon the subsequent working of the plant under ordinary conditions [given at the end of the paper].

The works were sufficiently near completion to allow the supply being transferred from the old to the new works on April 6, 1908; and once the seven miles of new supply-main had been thoroughly washed through, no trouble whatever was at first experienced in regard to the water. Subsequently, however, the water was found to have a thick, milky-white appearance; and this proved so persistent that the use of the new supply had to be temporarily abandoned. For several reasons (speed of delivery being one of the most important), the author decided to recommend the immediate installation of three "Bell" pressure-filters. These were connected up to the delivery-main from the pumps, so that the water could be pumped through them or direct to the reservoir at will. In the meantime, apparatus was set up for shelling out the bore-tube and for clearing the sand accumulated in the well, and by carefully dividing the time between "shelling" and pumping, the supply to Skegness was resumed and maintained without intermission, even during the month of August, when the demand reached something over 210,000 gallons in one day. On the first attempt to use the filters, it was found that their efficiency in dealing with the sand in the water was decidedly limited; and the author's experience in this connection may possibly be useful to other members. A careful analysis of the sandy matter deposited in the filters proved it to consist of fine grey sand with occasional fragments of very sandy clay and occasional nodules of black, hard rock. It was in the first instance thought that the argillaceous matter came from the clay beds at the bottom of the boring; but subsequent evidence tended to negative this opinion, and to point to a failure of the band of rock in which the 8-inch bore-tubes were bedded—thus allowing the clay from above the tube-end

to fall into the open boring. The effect of the clay on the filters was, however, fatal to their efficiency.

In view of the ultimate purchase of the undertaking by the Urban District Council, Mr. Brough Taylor, M.Inst.C.E., was asked to co-operate with the author in dealing with the sand difficulty; and the remedy which was proposed as a result of this consultation was the sinking of a second or duplicate bore-hole terminating at a depth of 210 feet, and 12 inches (minimum) diameter, adjacent to the first, but sufficiently far away to avoid the cavity formed by pumping out the loose sand from around the first boring, and connected with the pumping well by means of a syphon. The result has been entirely satisfactory; no further trouble with sand having occurred since it was brought into regular use. The filters have proved very serviceable as a safeguard against occasional discoloration or fine sand brought up with the water reaching the town, and there has been no necessity for further shelling of either the old or the new boring. A final test of the capacity of the works made in October, 1910, proved an available supply of over 300,000 gallons per day, or sufficient to meet the estimated maximum demand for some time.

Before leaving the subject of the sand difficulty, it may be pointed out that the trouble was certainly intensified, although by no means caused, by the small diameter of the first boring. The speed of the water, when drawn up at the rate of 18,000 gallons per hour through the 8-inch tubes, was undoubtedly excessive, and the author would urge the desirability of always providing ample area in bore tubes intended for other than experimental use. In the present instance the original intention was to consider the first boring as experimental only; and a diameter of 8 inches was ample for this purpose. The results as regards yield seemed further to justify the author in advising the use of this boring for permanent supply; and there is no doubt it would have been quite sufficient, apart from the sand difficulty.

As regards the alternative of sinking a well to the water-bearing beds, it may be pointed out that the cost of a well some 220 feet deep, with cast-iron cylinders and sand screens at the lower end, would have far exceeded that of the second boring—viz., £1224—and could not have proved more successful in overcoming the difficulty.

The next point of special interest in connection with these works was the adoption of reinforced concrete for the service reservoir. This was constructed on a hill top, 1¼ miles west of the pumping-station. The capacity is 400,000 gallons when full; and the reservoir is divided by a transverse partition, 5 ft. 6 in. high, into two parts, to provide for cleaning out the floor without throwing the reservoir out of use. To avoid the expense of laying a double line of main between the pumping-station and the reservoir the rising-main enters at the bottom, and serves as an outlet-main as well—in fact, during the time that pumping is in operation, the supply does not enter the reservoir except so far as the rate of pumping exceeds the demand at Skegness. No inconvenience has been experienced from the resulting risk that a leak in the main might possibly empty the reservoir, as, by providing proper supervision, assisted by automatic alarms at suitable points, the engineer has promptly dealt with the leaks that have occurred long before any loss of importance has taken place.

The system of reinforcement adopted is the + and H bar, securely wired at intersections; the roof being supported by concrete girders reinforced along lines of tensional stress. The internal dimensions are 100 feet by 70 feet in plan, with 10 feet depth of water. Theexternal walls are 8 inches thick at the base and 6 inches thick at top, supported at 7 feet centres by external counterforts, 12 inches wide, tapering from 1 ft. 9 in. at base to 9 inches at top (additional to thickness of walls). The floor was not reinforced. It is 9 inches thick, extending 12 inches beyond the external walls, and thickened to 12 inches under the piers. These are 16 inches square at base, tapering to 10 inches square at top, and are arranged at 16 ft. 8 in. centres along the major axis, and 14 feet centres on the minor axis. The roof is 6 inches thick, supported on concrete girders 12 inches deep (additional to thickness of roof) by 8 inches wide.

The top of the roof is rendered with 2 inches of cement, the inside of the walls with 1 inch, and the inside of the floor with 1½ inches.

As to the use of reinforced concrete for service reservoirs, the author is satisfied that, as regards economy and stability, the system is far more satisfactory than ordinary brickwork or concrete construction. The cost in this case (£2309) was, perhaps, somewhat below market prices, as the contractors were very anxious to secure the order. But, even so, the author is satisfied that ordinary construction of equal stability would have cost more than did the design adopted.

The author then refers to the 7 miles of 10-inch delivery main between the new pumping-station at Welton and the tower tank at the old works; and later in the paper he gives the actual cost of the various sections of the new works, as follows:—

Service reservoir	£2,309	7	4
Mains and laying	8,386	0	5
Venturi meter	187	18	6
Buildings and foundations	2,805	13	11
Telephone	554	4	3
Pumping machinery	2,285	12	10
Filters	1,111	9	6
Shelling boring, No. 1, &c	629	11	11
Second boring	1,224	3	4
Total	£19,494	2	0

Working Results at Welton Pumping-Station, Supplied by Mr. Ralph Hudson, Surveyor and Water Engineer, Nov. 22, 1911.

The total working costs, including repairs, renewals, wages, &c., of the suction-gas plant at our Welton Water-Works (which, of course, includes engines and pumps) for the year to March 31 amounted to £248 0s. 5d.; and the total quantity of water raised was 44,353,000 gallons. This works out at 1·34d. per 1000 gallons raised.

Fuel alone cost £91 1s. 10d., which works out at 0·49d. per 1000 gallons. This is, of course, much higher than the figure (0·25d. per 1000 gallons) given in the paper as the result of a twelve-hour test in January, 1909; but it will be readily understood that a large proportion of this fuel is consumed during the hours when the engines and pumps are standing idle.

The cost of repairs to the gas plant during the year amounted to £7 5s. 2d.; but it must not be forgetten that the plant had not cost anything for repairs for the previous three years during which it had been working.

I append hereto the results of a six-hour test carried out by me recently, from which it will be seen that the results now being obtained are better than those obtained in 1909.

The test was carried out under ordinary working conditions; no special preparations having been made: Coal used during test, 132 lbs. Cost of coal per ton delivered, £1 13s. Cost of coal used during test, 1s. 11¼d. Actual discharge measured at reservoir, 73,530 gallons. Amount consumed as per Venturi meter, 44,000 gallons. Scrubber water at 5 gallons per minute, 1800 gallons. Total amount of water raised, 119,330 gallons. Cost of raising water (coal only), 0·19d. per 1000 gallons, lifted about 200 feet.

TAR FOR ROAD SURFACES IN AMERICA.

At the Annual Meeting of the American Gas Institute, a paper was submitted by Mr. Alan D. Whittaker, of Atlanta (Ga.), on the methods adopted by the local gas company to create a business in tar and tar products.

In his introductory remarks, the author showed how the use of tar, to which in the early days of the gas industry not much attention was paid, had been extended by the discovery of the processes for treating timber with the oils distilled from it, and the production of aniline colours from benzol. Apparently, however, the demand for tar was not heavy enough to keep the price much above its value as fuel; and this condition did not improve with the advent of bye-product coke-ovens in America in 1894. The increasing use of water gas tended to keep down the production of tar. Meanwhile, the tar market was getting largely under the control of several important concerns operating big plants in different parts of the country, and making pitch, creosote, and roofing and paving materials.

In 1908, the conditions surrounding the tar business in Atlanta were not at all unusual. The Company's largest sales were of crude tar to a local roofing concern that distilled tar and made pitch, &c. They complained that there was too much free carbon in the tar, that their stills were being injured thereby, and that the resulting pitch was inferior. The tar was stored in an old gasholder tank, and the roofing company had the heavy coal tar. As this contained 25 per cent. of free carbon, the pitch was naturally not up to requirements. The sales fell off, and the tar business seemed to be at a standstill. The total stock on hand at the beginning of 1909 was 568,000 gallons.

The year 1909 was the critical one in the Gas Company's tar history. Their stock was increasing continuously, and their sales were small. They had storage capacity for several years in their gasholder tanks; and they decided to fall back upon this, if necessary, rather than accept any of the offers made by the large tar interests for the entire output at what seemed to be too low a price. They accordingly proceeded to "boom" tar for settling the dust on road surfaces. They equipped themselves with a tank-waggon, and in this way sold 39,000 gallons during the early summer, with satisfactory results. Later on they decided to erect a still, and see what they could do with the tar themselves. They managed to operate the still in a fairly satisfactory manner; and they at once found an outlet for their product by supplying road tar binder for a county road which was being made about eight miles from the gas-works under the direction of the Office of Public Roads. Their tar and tar product sales for the year amounted to more than three times those for 1908; and they gained in stock 260,000 gallons.

In 1910 the business increased, and they had to put in another still. The sale of roofing pitch assumed considerable importance, and they disposed of their creosote at good figures. Their stock of tar increased only 60,000 gallons; and they distilled 278,000 gallons. During the first seven months of the present year they used 103,000 gallons more tar than they made, and distilled 135,200 gallons. The results above recorded were achieved by a good deal of advertising and pushing sales.

Having launched into the tar business, the Company were in the open market with their competitors. Their success with road tar binder at the very outset was most encouraging. The authorities of the De Kalb County, Georgia, were about to make a road, using binder under the direct supervision of the Engineer of the Office of Public Roads. Some sample stretches were treated with different binders, and the Company's was accepted. This stamp of approval by the Government was of great advantage to them. Creosote oil began to accumulate, and they employed a salesman who had had considerable experience in another tar concern. He

was fitted out with an attractive sample case, showing the different oils, paints, shingle stains, &c. They advertised in the local daily papers and received inquiries and orders from Texas to Virginia. They got up an illustrated pamphlet on road tar, and copies of it were sent pretty freely all over the country. They had a representative in an automobile on the national highway from Atlanta to New York, and also in the good roads tour around Georgia. At the Appalachian Exhibition in Knoxville in 1910 the Company sent a car load of binder to be used on an object-lesson roadway built by the Government engineers; and they put up signs on the roads made with their material, stating: "This road was built with road tar binder furnished by the Atlanta Gas Company." Their tank-waggons have conspicuous signs over them.

The Company's list of articles for sale includes the following: Crude tar, at 6 c. to 10 c. per gallon in barrel lots, used for tar concrete, paint, damp-proofing, dipping castings, pipe-dip, roof coatings, wood-preserving, &c. Also water-gas tar is sold regularly to coal-gas works to thin-out the heavy tar in the hydraulic main. Pitch they sell at $11 to $14 per ton f.o.b. Atlanta. This pitch is used for roofing, paving, waterproofing, &c. Creosote is sold for wood-preserving, to disinfecting works, and to wood-creosoting plants where railroad ties, &c., are treated. Road tar binder is priced at 5 c. per gallon at the gas-works, or at 6 c. if delivered in the Company's tank-waggons. It is handled hot in the waggons; in some cases reaching the scene of operations hot enough to be put on the road without further heating. With the binder costing 5 c. per gallon at the gas-works, the additional cost of the fine road in De Kalb County was only 15 c. per yard above that of a clay-bound macadanized road, which would soon require 15 c. worth of repairs per square yard.

Having given a description of the Company's stills and the mode of operating them, Mr. Whittaker said he thought gas managers need not worry about coke-oven plants making lots of tar, nor need they fear that the oil companies' bye-products would destroy the tar market, so long as there were thousands of dusty highways and water-washed macadam pavements in existence. The "good road" movement was on. The United States were spending a million dollars a day on improving roads; but it would take all the gas tar, coke-oven tar, and oil products that the country could produce for a great many years before the roads were durable and dustless.

Appended to the paper were the Gas Company's specifications for a macadam road with a refined tar binder; and methods of examining road tars furnished by the Office of Public Roads.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas-Furnaces and the Daily Press.

SIR,—I am afraid that, under cover of the excuse that you do not wish me to break from my promise to deal further with the lighting problems, you pass too lightly over my complaint about the gas-furnace article.

You now say: "If he had kept to the subject of the heading of the article, there would really have been nothing to criticize." But you did criticize the matter which kept to the subject of the heading of the article. As I stated in my letter of last week, you made it appear, in your criticism of my article on the furnaces, that I had deliberately withheld certain facts. Your only reply to my complaint is, in effect, "there was really nothing to criticize." Surely then it is not fair to me to criticize the furnace details.

Another complaint. I am taking very great pains to present impressions concerning the gas industry, such as they come to me, and in no sense "arrogate to myself the position of judge and censor" of the engineers in the gas industry. On the contrary, I find too much expected of the engineers by the industry and too little pay given to them. I am quite free to express my impressions—if you can, by logical argument, convey further ideas on the subject of gas lighting or furnaces or the industry, I shall hold myself equally free to express those. And, after all, I might well complain that you "arrogate" to yourself the position of judge concerning the electrical industry.

I must re-state, apparently, my position on the whole correspondence. I expressed certain opinions concerning lighting problems publicly. You immediately challenged them—hinting at malice to the gas industry. I replied: "The opinions may be wrong; but most certainly not malicious. If I am wrong, many engineers are also wrong. Will you please supply more evidence?" You must confess that it would have been infinitely easier to have completely ignored your criticism. I did not do that—one great reason being that I wanted to obtain the gas engineer's point of view, and know from the gas engineer what he could do. I have learnt certain things from this correspondence, and am not too proud to acknowledge it. You, in your turn, have apparently also learned that it is time for increased activity among the caterers for the public custom.

"ENGINEERING CORRESPONDENT" OF THE "DAILY TELEGRAPH."

Dec. 20, 1911.

[Regarding this letter, the second paragraph is the only one that calls for reply; the remainder can be left to the judgment of readers who have followed the controversy from the "Golden Lights" article onwards. As to the second paragraph, the "Engineering Correspondent" shows that he is over-sensitive, and has magnified the least important part of our article commenting on the diverse subjects dealt with by him in his article headed "Gas-Furnaces"—several of which subjects were as foreign to gas-furnaces as chalk is to cheese. Let us see what our comments on the part of the article treating of gas-furnaces amounted to. He says that we made it appear that he had "deliberately withheld certain facts." The only fact that we said he had omitted was that electricity was included in the trials of the Royal Mint authorities. Then we remarked that "the directions of economy [using gas-furnaces in industry] were pointed out fairly" by "Engineering Correspondent;" and we merely added to the economies he suggested. Succeeding this, in reply to his point as to more not having been done in the past in the gaseous heating line in manufacturing operations, we gave reasons showing that the blame did not rest entirely on the gas industry, but must be shared largely by the statutory trammels which had hindered progress. We do not agree that in these comments there is anything in the nature of criticism of which complaint can, with any sincerity, be made. The remainder of our article was devoted to matters, introduced by "Engineering Correspondent" in his article, that cannot, by any stretch of the imagination, be claimed to have anything to do with gas-furnaces.—ED. J.G.L.]

Our Questions, and How Far they are Answered.

SIR,—It is proposed this week to deal only with that portion of your editorial criticism which appeared in the second and third columns, pp. 591-2. Your correspondents will, I am sure, be fully aware that this implies no discourtesy to them, but is simply an endeavour to deal fully with your points. Others will be taken up later. The replies to your series of questions are:

(1) Whitehall and Westminster have recently been watched carefully. The light from the gas-lamps is very good. Concerning the term "like candle power," there seems some difficulty of agreement between gas and electrical engineers. As to the costs, there also seems great disagreement. I will discuss them later.

(2) Why both arc lamps and gas-lamps have been re-placed one by the other in different parts of London must be also a matter of disagreement between the rivals. A plausible canvasser, a shop-keeper's whim, a change in terms of supply—any of these would affect the matter. The gas-lamps score in the many shops where only one large lamp is convenient. The serious drawback to the arc lamp is that there must be at least four in series on 220 volt. D.C. circuits. On the A.C. circuits this does not apply. I was in October not aware of the replacing since mentioned by you.

(3) Some of the districts have been visited. I again come to a question of opinion and not facts; and remembering the way in which my opinions, as expressed in the "JOURNAL," have been treated, it would serve no good end to continue to express them.

(4) The information was privileged, as is a good deal of that published in the "JOURNAL."

(5) Concerning the windproof mantles, on Sunday, Nov. 26, and on Nov. 19, the bye-passes along the Lewisham High Road were counted at about 7 p.m. [The 19th was a very windy night; the 26th fairly windy.] On the 19th, 12 out of 71 bye-passes were blown out; and on the 26th, 8 out of 71. The lamps are not lighted up full on Sundays. The bye-passes had been exposed to the wind for 21 hours. The lamps are not lighted on Thursday. Particular attention has been paid to the condition of mantles in a wide thoroughfare inside the three-mile radius. Several of the shop-window mantles have been seen broken on any one night, and in many cases (quite 25 per cent.) it was observed that the mantles were not giving their best light.

(6) The point is, as explained above, that the economy of the flame arc is not possible except by combined working.

(7) Concerning Mr. W. B. Farquhar's figures, as the gas-main was free, as the gas-compressor depreciation is spread over twenty years, as the cost of the brackets and bye-pass gas-service is neglected, I must assume this a particular, and not a general, case. It was not that Mr. Farquhar's particular case was criticized; it was whether it was a general case. You cannot accept a free gas-main as evidence of the low cost of an illuminant.

(8) The original statement was made because the source of information was considered reliable. Among other things, it had been noticed that David Greig (a large retail provision merchant) uses them for lighting shops wherein there are large stores of butter and cheese. However, since Dr. Marchant's public statement has been given full publicity, the matter should be considered ended.

(9) When this was written, the writer had been recently informed by a leading medical authority that none of the chief hospitals were lighted by gas. Apparently you can quote medical authorities who commend gas lighting. Will you please do so?

(10) This was the opinion of librarians known to the writer. The point is, perhaps, Does the sulphur reach the books? It undoubtedly reaches the fittings.

(11) This matter is explained by your correspondent A.V.H. I confess I did not appreciate any difference between carbonic acid gas sterile and that which is not sterile.

(12) The only answer to this is that, so far as the writer can discover, none of the leading fire insurance companies make any distinction.

(13) The gas industry can, and certainly will, flourish, by cultivating loads in metallurgical, heating, and other directions. There are enormous developments (quite apart from lighting) which may reasonably be expected in the next few years.

Having explained these points in detail, I may add that I now find that, in my impressions of the progress of electrical engineering—a branch of the profession whose members have kept fairly closely in touch with me through the "Daily Telegraph" address—I was rather too ready to accept statements from sources at the time considered reliable. At first sight, it would seem that it would have been very much better to have omitted all reference to gas. In which case, however, I should possibly have never had the opportunity of reading this correspondence in the "JOURNAL."

After these replies, I now wish to pass on to figures—next week. I am honestly desirous of knowing how far your figures are accurate. I have explained the above matters in detail, simply because I am anxious to find out exactly what can be done by gas. I expect that you, in your turn, will answer my questions. I do not, however, propose to go on discussing past or present opinions. What I am wanting are accurate figures, which you are apparently in a position to supply. My own view is that little good is to be obtained by raking up the past. We want to deal with the figures, and not with the opinions.

"ENGINEERING CORRESPONDENT" OF THE "DAILY TELEGRAPH."
Dec. 20, 1911.

[We should much have preferred that our friend had waited until opportunity allowed him to deal categorically and with fullness to the whole of the points raised in this controversy. To treat them piecemeal in this way is only calculated to prolong the discussion, and to set the ball rolling on to side-issues. A further communication is promised; and therefore we will, in order to preserve as much compactness as possible, defer our comments until we have before us all that our correspondent considers necessary as a justification (or admission of the unfairness) of his own articles, and as a reply to our criticisms. All that need be said at the moment is that the further he goes, the more he proves, by his own pen and confessions, the shallowness (so far as gas is concerned) of the knowledge upon which the "Golden Lights" article was written. And, further, certain of the statements now made do not answer ours; and the questions addressed to us are obviously an attempt to throw upon us the work of proving "Engineering Correspondent" was wrong, before a preliminary statement is made by him to show how strong, or otherwise, was his position by producing the evidence on which in October last he took his dogmatic stand. However, if he will own at once that he has no better justification on those points than is offered in this letter, then we will deal with them in our full comment when our correspondent has completed his reply. However, the confession in the last paragraph but one of the above letter atones for much that was said in the "Golden Lights" article. But there will not be satisfaction in the gas industry until the statements in this paragraph and something more have appeared in the columns of the "Daily Telegraph," either from "Engineering Correspondent" himself, or, failing that, in some other form. It would be much better, however, if "Engineering Correspondent" would show his courage, and himself tell the readers of that paper that he did the gas industry the injustice of attacking it, and the injustice of attempting to blacken the character of its staple product, on information that he has found was not trustworthy.—ED. J.G.L.]

PARLIAMENTARY INTELLIGENCE.

PROJECTED GAS LEGISLATION FOR NEXT SESSION.

Two Amalgamation Schemes.

Bills have now been deposited to sanction the carrying out of the two principal amalgamation schemes relating to gas companies of which notice was given last month, as recorded in the "JOURNAL" at the time. We are consequently in a position to give some additional particulars in regard to them.

South Suburban Gas Bill.

This Bill is to authorize the acquisition by the South Suburban Gas Company of the undertakings of the Bromley and Crays and West Kent Gas Companies, and to confer further powers on the promoting Company. The transfer is to take place as from the date of the passing of the Bill; and the two Companies whose works are acquired will then be dissolved. Ordinary stock of the South Suburban Gas Company is to be issued for similar stock of the Bromley Gas Company, at the rate of £111 8s. 8d. of the former for every £100 of the "A" stock of the latter, of £85 14s. 4d. for every £100 of "B" stock, and of £102 17s. 2d. for every £100 of "C" stock. Holders of 4 and 3½ per cent. debenture stock of the Bromley Company will receive an equivalent amount of debenture stock of the South Suburban Gas Company. Holders of original shares in the West Kent Company will have £20 of West Kent ordinary stock; and holders of fully-paid additional shares, £14 of stock. This stock is to be entitled to a standard dividend of 5 per cent. per annum, subject to a sliding-scale. The promoting Company ask for power to create ordinary and debenture stock for the purposes of the transfer. Holders of "A" stock of the Bromley Company are to have a dividend of 6 per cent.; of "B" stock, 4½ per cent.; and of "C" stock, 5½ per cent. Holders of original and additional shares in the West Kent Company will have 10 and 7 per cent. respectively. In all cases, the dividends are to be subject to deduction for income-tax.

The Chairman of the Bromley Company is to join the Board of the South Suburban Gas Company; and the Directors of both the Bromley and Kent Companies will retire at the date of the transfer of the undertakings. Each Director of the Bromley Company (including the Chairman) is to be paid as compensation a sum equivalent to seven years' purchase of his annual remuneration (with the income-tax thereon), calculated upon the average of the 3½ years immediately preceding the date of transfer. Seven years' purchase of the amount received by each Director of the West Kent Company in the year immediately preceding the transfer is to be paid to him; and three years' purchase of their remuneration to the Auditors. Officers of both Companies are to be taken over as may be determined; but provision is made for compensating those who will not be required. The promoting Company will continue to pay all pensions granted by the other Companies; and they reserve to themselves the right to commute them.

With regard to the price of gas, the Bill provides that as from July 1, 1912, the charge for a supply by meter in the Bromley Company's district is to vary in accordance with a schedule. In certain places specified, it will be 7d. per 1000 cubic feet in excess of the price for the time being of the South Suburban Company; in other places, 10d. until June 30, 1918, and 7d. afterwards. In the district of the West Kent Company, the extra charge is to be 1s. 9d. until June 30, 1917; 1s. 2d. until June 30, 1922; and afterwards 7d. From and after the passing of the Bill, the limits of supply of the promoting Company are to be extended so as to include the parishes of Cudham, Downe, Halstead, and Knockholt, in Kent.

The other provisions of the Bill relate to the allowance of discounts, the laying of pipes in private streets, the creation of a special purposes fund, the definition of the paid-up capital of the promoting Company, and the determination by the Directors of the remuneration of the Secretary.

Wandsworth, Wimbledon, and Epsom District Gas Bill.

The purpose of this Bill is to effect an amalgamation of the Wandsworth and Putney, Wimbledon, and Epsom and Ewell Gas Companies. It is proposed that the amalgamation shall take effect as from Jan. 1, 1913, on which date all persons who immediately before the amalgamation were members of the three Companies are to be united into a Company having the name of the Wandsworth, Wimbledon, and Epsom District Gas Company. The capital of the proposed new Company is to be £1,362,471 17s. 3d., which is to be divided into "allocated paid-up capital" and "unallocated capital." The total amount of the former is fixed at £923,179 5s. 4d., which represents the paid-up capital of the Companies, including premiums amounting to £79,468 5s. 4d. The allocated paid-up capital (excluding premiums) is to be divided in the following proportions: £393,711 to the Wandsworth and Putney Company, £352,000 to the Mitcham and Wimbledon Company, and £98,000 to the Epsom and Ewell Company. The total amount of the unallocated capital is £439,292 11s. 11d., which represents the balance of the authorized, but unissued, capital of the Companies. This capital it is proposed to raise by auction or tender, either as new ordinary stock or new preference stock. Upon the total capital of the new Company it is proposed to issue debenture stock to an amount not exceeding £328,749 6s. 8d., which is inclusive of the aggregate sum of £155,496 already issued by the Companies. The dividend on the allocated capital is 5 per cent. on the Wandsworth "A" stock, and the Wimbledon and Epsom stocks; and 3½ per cent. on the Wandsworth "B" and "C" stocks. On the unallocated capital it is to be 3½ per cent.

The limits of supply are to be those of the three Companies; and the prices those now authorized—viz., 4s. per 1000 cubic feet within the Wandsworth and Epsom limits, and 3s. 2d. within the Wimbledon limits, subject to a sliding-scale. For prepayment supplies, the Company may demand a not greater charge than that paid by private ordinary consumers in the respective limits who have their gas through any other kind of meter, or by any other method of supply. They may charge up to 10d. extra per 1000 cubic feet for the hire of the meter and fittings, and up to 1s. if a stove is included. The illuminating power of the gas is to be 14 candles; and the "Metropolitan" No. 2 burner is prescribed for testing it. The Bill, however, contains special provisions relating to the testing of gas in the Wandsworth and Wimbledon limits, the depth at which mains are to be laid in the latter district, and the construction of works in the Epsom limits.

The Company will take over such officers of the other Companies as may be willing to serve; and compensation will be paid to those not required. The compensation to Directors and Auditors relinquishing office by reason of the amalgamation will be seven years' purchase of the fees receivable and a sum equal to three years' remuneration respectively. There are to be nine first Directors of the new Company; but they may be reduced in time to six, and then they are to remain at this number.

LEGAL INTELLIGENCE.

RATING OF LICENSED PREMISES FOR WATER SUPPLY.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Dec. 20.

(*Before Mr. Justice* PARKER.)

Metropolitan Water Board v. Phillips.

This was a special case, asking the opinion of the Court on agreed facts. The action was brought to have determined the rateable value on which the water-rate of licensed premises know as the Brown Bear, No. 79, Aldersgate Street, should be calculated for the quarter from Oct. 1 to Dec. 31, 1910. The premises, during the whole of the quarter, and of the preceding and succeeding quarters, were supplied with water by the Board under the provisions of their Charges Act of 1907, and under section 8 the payment was to be made at a rate per annum which should not exceed 5 per cent. of the rateable value of the house or building in respect of which the supply was required. Section 13, sub-section 1, provides that the rateable value of any house or building shall be determined by the valuation list in force at the commencement of the quarter for which the water-rate accrues, or, if there is no such list in force, by the last rate made for the relief of the poor, or other rate in which such last-mentioned rate is included. By section 70 of the Water-Works Clauses Act, 1847, which is incorporated with the Charges Act, it is provided that water-rates shall be paid in advance by equal quarterly payments, on the usual quarter days;

and by section 15 of the last-named Act it is provided that, notwithstanding anything contained in section 70 of the Act of 1847, the days for payment shall be 1st of April, July, October, and January. In the year 1908, the valuation list then in force in the City of London was altered by the making of a supplemental valuation list, in which the rateable value of defendant's premises was put at the sum of £400; and plaintiffs' contention was that the water-rate for the quarter from October to December was to be calculated upon the rateable value shown in the list coming into force on the 6th of April. On June 2, 1910, the Overseers of the parish sent to the Assessment Committee a provisional list, in which the premises were included at the reduced rateable value of £399; and on the 23rd of June, the Clerk to the Assessment Committee served upon the defendant, as the occupier, a copy of so much of the list as related to his premises. This was accompanied by a notice specifying a day on or before which objection to the list might be made. On the 3rd of October, the Assessment Committee considered the list, and reduced the rateable value of the premises to £234. Section 43 of the Valuation Act, 1867, provides that such list shall come into force at the beginning of the year commencing on the 6th of April, and shall last for five years. In September, the defendant paid for the quarter from July to September the sum of £5, being at the rate of 5 per cent. upon the rateable value of £400. If the provisional list formed part of the list in force at the commencement of the quarter from October to December, and the water-rate for that quarter was to be calculated upon a rateable value of £234 instead of £400, plaintiffs admitted that the same principle applied to the previous quarter, and that the defendant was entitled to credit for £2 1s. 6d. Defendant had tendered £3 15s. 6d. for the quarter from October to December; but plaintiffs demanded £5. The question for the opinion of the Court was whether, upon the true construction of the Charges Act, and the circumstances stated above, the value for the quarter in question ought to be £234.

Mr. ROMER, K.C., and Mr. J. GORDLAND (instructed by Mr. Walter Moon, the Board's Solicitor), appeared for the plaintiffs; Mr. RYDE, K.C., and Mr. E. M. KONSTANS (instructed by Messrs. Maitland, Peckham, and Co.), represented the defendant.

At the conclusion of the arguments,

His LORDSHIP delivered judgment. He said the question to be decided was whether the provisional list came into force at the date on which it was signed and approved by the Assessment Committee, or, within the meaning of section 13 of the Charges Act, when a copy of the list was served on the occupier. A distinction existed both logically and practically between the two positions. A list might come into force at one date and yet have a retrospective effect; but it did not follow that because it had that effect it could be said logically to have been in force at an earlier date. The question, therefore, was whether a list in force as referred to in the section named was the one actually in force, or was a list subsequently made and a retrospective effect given to it. He did not think the meaning of section 47 was that the provisional list was to be in force as from a prior date so as to disqualify persons who were qualified under section 45. Giving the best attention he could to this loosely drawn section, he thought the true view was that the valuation list remained in force until altered by a supplemental or provisional list, and the alteration by a provisional list was not made until the Assessment Committee had decided the objections brought in, and signed it, as provided by the Act. Having come to the conclusion that the list in force was the one which governed the rating arrangement of the district, irrespective of any provisional list, until that list was signed by the Clerk of the Assessment Committee, he thought he was bound to conclude that the list referred to in section 13 was the list, unaltered by any provisional list, unless and until the provisional list had been signed after the objections had been dealt with. It consequently followed that the plaintiffs were entitled to succeed in the action; and judgment would be entered in their favour, with costs.

A stay as to costs was granted with a view to an appeal.

LIVERPOOL WATER-WORKS ASSESSMENT APPEAL.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Dec. 21.

(*Before Lords Justices* VAUGHAN WILLIAMS, BUCKLEY, *and* KENNEDY.)

Corporation of Liverpool v. Assessment Committee of the Chorley Union.

This was an appeal from the decision of the Divisional Court, on the 25th of January last, with regard to the liability of the Liverpool Corporation to be rated in respect of part of the gathering-ground of the Rivington reservoirs—viz., 1165 acres out of a total of some 10,000 acres belonging to them—which lies within the district of the Chorley Union. [See "JOURNAL," Vol. CXIII., p. 537.] The appeal was opened on the 16th of October, and continued for two days, when the further hearing was adjourned. [See *ante*, p. 256.] The arguments were resumed on the 13th ult.; and at their close on the 15th, judgment was reserved. This was given to-day.

Lord Justice VAUGHAN WILLIAMS said it was admitted, on the special case, by the Corporation of Liverpool, that they were in occupation of 306 acres of plantations and nurseries; but they claimed that they were not in occupation of 859 acres of moorland, and were not rateable in respect of this part of the ground. He agreed with the Divisional Court and with the other members of the Court that the Corporation were in rateable occupation of the 859 acres. He assumed, as said by Lord Atkinson in the House of Lords, that though ownership of a hereditament did not necessarily imply occupation for the purpose of rating, and though a person or a company might be an occupier within the meaning of the Statute of Elizabeth, who had no proprietary interest in the soil, yet the owners in possession by title were *primâ facie* occupiers, unless it were shown that the occupation was by someone else. In the present case, there was no contention that any other person in fact occupied; and *primâ facie*, therefore, the Corporation were in occupation. The question consequently was, whether that *primâ facie* inference had been displaced, and, if so, how. He thought, for the reasons given in the Divisional Court, the conclusion had not been displaced. The principal part of the argument against this conclusion was based upon the proposition, established by several cases which had been cited, that a vacant house—and he thought the decisions covered vacant land—was not occupied for rating purposes. They were invited in this case to draw certain inferences of law from the decisions and the well-established practice that empty houses and empty land were not the subject of rating, and to say that, inasmuch as the land was not purchased for occupation, but for the express purpose of not being occupied, they ought to apply to this vacant land the rule as to vacant houses. His reason for not drawing this inference was that, on looking at the cases, the only way of accepting the principle applied to vacant houses as part of the law of rating was that, for convenience or some other reason, it had been determined by judge-made law that houses should be excepted from the general rule; and when one read the recent decisions, it was impossible to avoid the conclusion that, however much this law might be formally enforced, it was a special exception from which no logical consequences could be drawn. It was a decision of practical convenience, which negatived the right or duty to draw practical conclusions therefrom. He agreed that, if one had to draw practical conclusions, there would in this case be a great deal to show that the land in question was vacant. With regard to the right mode of assessing the 306 acres of plantations and nurseries, the decision of the Court of Quarter Sessions was that they should be assessed, under section 4 of the Act of 1874, at 2s. and 15s. per acre respectively; but this was on the assumption that the Corporation were not in rateable occupation of the whole 1165 acres, with the exception of the plots used as plantations and nurseries. Now that this assumption had been negatived, it followed that the question of fact to be decided by the Court of Quarter Sessions—viz., the value and the mode of assessment—was entirely different. In his judgment, the assessment and value had still to be decided by the Court of Quarter Sessions; and the case must go back for this purpose. It might be that the occupation of the plantations and nurseries might be such that the plantations could easily be let from year to year. No evidence was given on this point; and, on the finding that the 859 acres were not occupied for rating purposes, this question of fact did not arise. It had been argued that the question of fact ought not to be sent back, because the order of the Divisional Court, as amended after the hearing, found that the Corporation were in rateable occupation of the whole of the 1165 acres, and therefore the second and third questions in the special case became immaterial if and so far as the plantations and nurseries were part of the gathering-ground, and that they should be assessed at 2s. and 15s. per acre respectively; and that the price paid for the gathering-ground was no evidence of the rateable value of the land used for plantations and nurseries. This part of the order plainly contemplated that the Court of Quarter Sessions would consider this question. In his opinion, the application as a measure of value of the interest upon the price paid did not apply generally to property which could be let from year to year. It was for the Court of Quarter Sessions to decide on evidence whether this was the case with these plantations and nurseries. The application of the measure of interest on the price was a question of fact to be determined at Quarter Sessions. Inasmuch as the main question fought was that of whether or not there was a rateable occupation of the moorland—and the argument largely turned on this question—the appeal would be dismissed, with costs.

Lord Justice BUCKLEY gave judgment to the same effect; pointing out that the Corporation derived considerable benefit from the ownership of the land in question, inasmuch as they were able to prevent it being occupied by population, who would not only contaminate the water, but also, by making use of it, reduce the quantity available for the Corporation.

Lord Justice KENNEDY also gave judgment to a similar effect.

The appeal of the Corporation was therefore dismissed, with costs; and the matter goes back to the Court of Quarter Sessions to determine the amount of the assessment.

Liability for a Burst Water-Main.

At the Westminster County Court, last Thursday, Mr. David Marks, of Bloomsbury, and Mr. Samuel J. Wells, of Poplar, claimed £15 and £20 respectively from the Metropolitan Water Board, as damages sustained to their property in consequence of the negligence of the Board's servants. The only dispute was as to liability. The case for the plaintiffs was that Mr. Marks was the owner, and Mr. Wells the tenant, of a house in Augusta Street, Poplar. Last June, defendants repaired a main-pipe in the street; and a fortnight later, early in the morning, the main burst—the water shooting up on the roof of the house, and smashing the windows and window-frames. For the damage to the roof and other parts of the structure the landlord claimed, and for that to the furniture the tenant claimed. The Board's workmen said the second burst was due to a bad joint and a short pipe; and at the second repairing a double collar was put on the joint. The defence was that there was a leakage on June 8, and the ground was opened and repairs executed; no new pipe being issued for the job. On June 24, another leakage was reported; and upon opening up, a new burst was discovered. The second burst was not a result of the first repairing. The pipe, showing a fracture, not at a joint, was produced. It was denied that the Board's men made the remarks alleged. His Honour Judge Woodfall stopped the case after hearing some of the witnesses for the defence, and said that no negligence had been proved. The only evidence was that of the alleged statements of the workmen; and after hearing the men, he must give judgment for the defendants. It was rather hard upon the householder. Counsel for the Board said he was instructed not to ask for costs; and judgment was entered for the defendants, without costs.

Mr. J. W. Southcott, of the Londonderry Gas Company, has been appointed Outdoor Superintendent in the Gas Department of the burgh of Airdrie, in place of Mr. A. M. Taylor, who has obtained a similar appointment under the Gas Department of the Hereford Corporation.

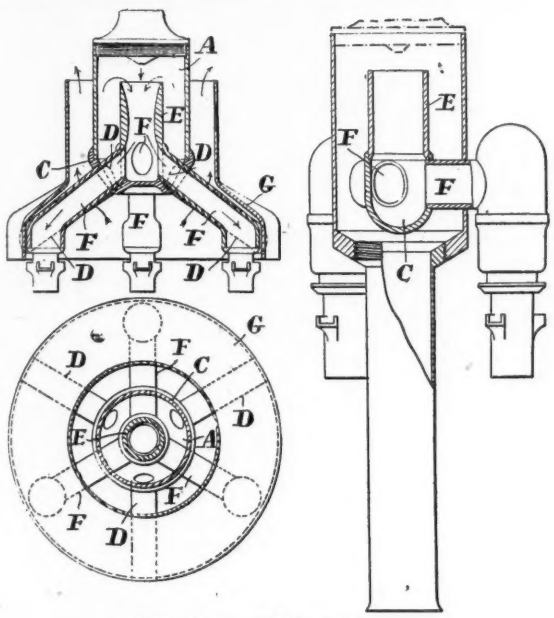
REGISTER OF PATENTS.

Inverted Incandescent Cluster Burners.

COLBRAN, J. B., of Chiswell Street, E.C.

No. 26,611; Nov. 16, 1910.

With this burner, air passes up between the mantles into the space between the walls of a cylindrical chamber and a cup-shaped tube; the air in its passage being heated by the mantles. From this space it travels up to and over the top of a vertically extending flared-shaped nozzle and down the interior of it, meeting at the top of the nozzle the gas which is admitted to the cylindrical chamber, after having been passed direct to the chamber in a vertical or horizontal manner.



Colbran's Inverted Cluster Burners.

In the first arrangement shown, the burner consists of a centrally disposed cylindrical chamber to the top of which is connected the gas inlet tube, provided with a needle valve; while the bottom of the chamber is closed by a cup-shaped body C, from which extend radial and downwardly inclined suction air tubes D, placed between the mantles. The body is provided with a central flared nozzle E, from the bottom of which extend the bunsen tubes F, to which the mantles are connected. The mouth of the nozzle is below, and in proximity to, the nipple of the regulating device of the gas-inlet. The supply of air and gas to, and the control of, all the mantles is effected by one regulating device.

The air as sucked in between the mantles is heated by the heat from the lighted mantles; the heat being conserved by the burner hood or jacket G; while from the space over the top of the nozzle E the gas is passed directly to the main chamber, and is primarily heated by the cup-shaped body C, which is heated by the burnt air escaping through the outlet of the jacket G. The warmed air and gas now pass down the tube E to the radial bunsen tubes F and the mantles; the warm mixture, in its passages through the pipes F, being again heated, or superheated, by the products of combustion from the burners.

In the second form of construction, the radial suction air-tubes are dispensed with, and the air is sucked up into the burner by way of a tube extending vertically and centrally downwards from the main chamber, in which is the cup-shaped body C, from which lead the bunsen tubes F.

Air-Gas Apparatus.

COX, F. J., and the MACHINE GAS, LIMITED, of Gray's Inn Road, W.C.

No. 28,818; Dec. 12, 1910.

This invention has for its object to provide an automatically operating pressure regulator for the volatile liquid employed in apparatus for the manufacture of air gas, so that under all conditions of use the proportion of the volatile liquid admitted into the carburettor shall be proportionate to the air passed through for its vaporization.

Accordingly, the patentees provide a casing or pressure chamber which may advantageously be constituted of part of the air-pipe circuit and integral with it, and mount therein a piston or diaphragm which is capable of a determined movement according to the pressure prevailing in the receptacle. The piston device is connected to a valve, which permits of the opening or closure of the conduit leading to the carburettor to a degree determined by the position of the diaphragm; and the piston or diaphragm is connected by links to a cock or valve regulating the admission of the volatile liquid to the carburettor.

The diaphragm or piston is so set that, on a certain determined pressure being attained in the receptacle, the valve controlling the passage of air to the carburettor is opened to a determined extent, as well as the valve or cock admitting the volatile liquid; and a valve device is provided (operating from the gasholder bell) for regulating the outlet of surplus air from the pressure chamber.

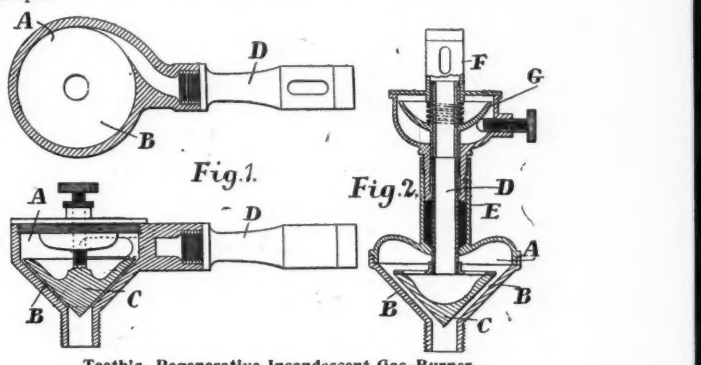
On the gasholder bell reaching its uppermost position, the valve device for controlling the surplus air is opened, so that the pressure within the chamber will be reduced; and thus the valve controlling the supply of air to the carburettor and the cock controlling the supply of volatile liquid are shut down to a corresponding extent, and maintained there until normal conditions are again established. Similarly, if the gasholder bell descends beyond the determined minimum limit, the valve controlling the outlet for surplus air will be closed, or partially closed; and thus the air in the pressure chamber will increase in pressure, and the valve controlling the supply of air to the carburettor and the cock or valve controlling the supply of volatile liquid will be opened. In this way, the carburettor is "effectively controlled, and the proportion of air to vapour is maintained substantially constant."

Regenerative Gas-Burners.

TOOTH, L. F., Commercial Gas Company, Stepney.

No. 29,163; Dec. 15, 1910.

This incandescent gas-burner has a heating chamber disposed over the mantle or flame, and contains a coned block, or its equivalent, of approximately the same shape as the chamber, for "causing the mixture of gas and air to pass to the burner-nozzle in hollow column or film form—the principal object being to prevent back-lighting at the gas-spit."



Tooth's Regenerative Incandescent Gas-Burner.

Fig. 1 is a part sectional plan of a burner casing in its simplest form and without the valve and cover—the gas and air mixture entering at the side of the casing; also a side sectional elevation of the burner with the casing. Fig. 2 is a sectional elevation of a modified form of burner in which the gas and air enter from the top of the burner.

The chamber A has a conical shaped lower part B, the apex of which is formed with, or carries, the burner and mantle. Inside the chamber is a block C, of cone shape at one part to correspond with B. It is carried by a screw-threaded rod operable from outside the chamber so as to adjust it to determine the space between the conical portion of the block and the corresponding part of the chamber. The block may be of any shape at the upper part; but it is preferred that its top has an annular recess extending from near a raised portion in the centre to the edge, and that the bunsen tube D be led into the chamber in such a manner that the gas and air passing into it would be forced to travel in a centrifugal manner around the top of the block before passing through the annular space between the block and chamber wall to the burner. The chamber, with its cone inverted, is positioned over the mantle," so that the uprising products of combustion impart heat to it and the gaseous mixture as it passes to the burner, whereby it becomes regenerative."

According to fig. 1, the block is carried by a cover screwed into the top of the casing; and the gas and air passing along the passage to the side of the casing "will partake of a centrifugal motion assisted by the annular recess before taking a downward course to the burner."

In fig. 2, in which the bunsen tube is arranged vertically and not at right angles to the casing, the casing has an extension tube E, having screwed into it a tube carrying a chamber formed with, or having attached to it, a tubular stem F (having air holes), screw-threaded internally, for attachment to the usual gas-nipple. Inside is the bunsen tube D, this being made preferably in two parts—the upper end carrying a curved flange G which is acted upon by a screw passing through the side of the chamber. The lower end of the bunsen tube carries the valve C, in this instance provided with a hollow or recess in its upper part. Between the flange G and the stem F is a spring which normally tends to keep the valve C near the coned portion of the casing.

Indicating the Flow of Fluid through a Conduit.

CHRISMAN, H., of Allegheny, Pennsylvania, U.S.A.

No. 13,106; May 31, 1911. Date claimed under International Convention, Aug. 29, 1910.

This invention has for its object to provide a meter system for recording the normal and also the abnormal flows traversing a water-main employed for ordinary distribution purposes and also for fire service.

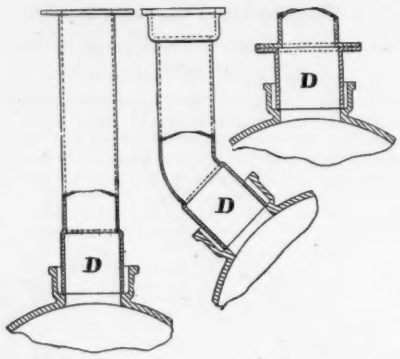
In patent No. 172 of 1911, it was proposed to provide a meter system of this character with a meter for measuring normal flows in the main, and an indicating device or additional meter actuated by the water only during abnormal flows—a port or passage leading to the indicating device from the water-main being uncovered by the movement of the meter when an abnormal flow occurs. According to the present invention, the movement of the main meter uncovers the outlet from the additional meter, which is employed for measuring or recording abnormal flows. Other features of the invention relate to the means for maintaining the normal flow meter in its operative position, and to other constructional improvements in carrying the invention into practice.

Gas-Retorts Ascension Pipes.

MILBOURNE, R. J., of Muxton, near Newport, Salop, and TURNER, J. W., of Scunthorpe.

No. 1847; Jan. 24, 1911.

The patentees provide a chamber at the foot of the ascension pipe adjacent to the outlet of the retort mouthpiece, on the walls of which chamber the pitch and carbon can deposit—the arrangement allowing of the removal of the deposit on each occasion that the retort is drawn, "without the removal of any special part and without disconnecting any joint."



Milbourne and Turner's Ascension Pipe.

In one arrangement the spigot end of the ascension pipe (whether arranged vertically or at an angle) is formed of an increased diameter for any convenient length (say), for example, 9 inches, thereby forming a chamber or recess in which the carbon or pitch is deposited, "and which prevents the deposit creeping up the sides of the pipe beyond the upper extremity of the chamber or recess."

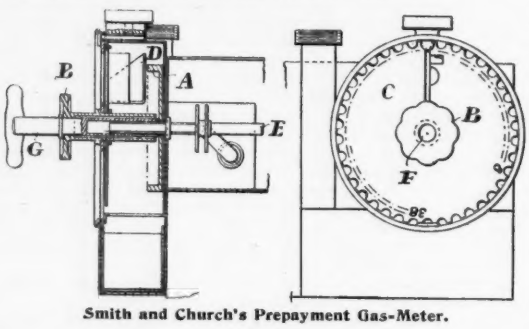
In all three modifications shown, D is the chamber or enlargement provided at the foot or spigot end of the ascension pipe. It may be formed in one piece with the ascension pipe, as shown in two of the arrangements, or as a separate piece and bolted to the ascension pipe, as illustrated in the third sketch. The chamber in all cases serves as a trap for the pitch and carbon which are deposited in the chamber, and are thus prevented from reaching the ascension pipe proper."

Prepayment Gas-Meters.

SMITH, E. W., and CHURCH, S., of Kennington Park Road, S.E.

No. 7305; March 23, 1911.

This invention (in the words of the patentees) consists of "a combination of features which add to the convenience of both the consumer and the gas company's collector." The combination can be carried out with various forms of coin-freed meter, and the key or equivalent employed by the collector in the stop system "may operate the mechanism in any convenient manner;" but for a simple and satisfactory form of construction they propose to employ the coin-freed mechanism described in patent No. 13,184 of 1910.



Smith and Church's Prepayment Gas-Meter.

The illustration is a sectional view of the coin-freed part with a stop arrangement (the key being in position), and an external view of the mechanism with the key removed.

The crown-wheel A can be locked to the exterior handle B by a coin in the manner described in last year's patent. The front plate C, coin-carrier D, and main spindle E are as dealt with in patent No. 9961 of 1908; but a central hole F is formed in the handle, through which hole a key G can be inserted—the end of the key being shaped to engage the spindle E and rotate it to an amount indicated on a dial outside the meter.

Valves for Coin-Freed Gas-Meters.

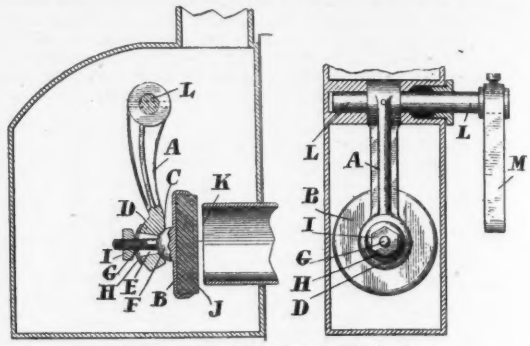
GLOVER, THOMAS, of Edmonton.

No. 8301; April 3, 1911.

The object of this invention is to construct a valve principally for use with coin-freed gas-meters in such a manner that it "automatically adjusts itself and makes perfect contact on its seating irrespective of the angle of such seating."

A side sectional elevation of the valve, a seating, and a casing, and a front view of the valve with the casing in section, are given.

The end or portion of the arm A carrying the valve B is constructed of concave-convex (C D) formation, with a conical hole E through it—the smaller end of the hole being on the concave side C. The valve is of the disc kind, with a bulbous or semi-spherical portion F at the centre. A screw-threaded or other rod G projects from it and is passed through the hole in the arm. The semi-sphere F is positioned in, and is of the same corresponding diameter as, the concave portion of the arm, so as to fit it. On the convex portion of the arm, and encircling the rod E, is a concave-convex plate H (preferably springy), which fits



Glover's Coin-Meter Valve Mechanism.

the convex portion of the arm; and the valve B and plate H are held to the arm tightly by a nut I, being connected to the rod G so as to press the plate and draw the portion F of the valve in close contact with the arm. The valve B is made to receive a washer J, which has action upon the valve-seating K; and by the shape of the arm, the valve, and the plate H, the valve can automatically adjust itself to any angle of the valve-seating. L is the axle on which the arm A is fixed, and M a wiper for operating the arm from any appropriate mechanism.

APPLICATIONS FOR LETTERS PATENT.

27,752.—CHANDLER, S., and WALLER, B. B., "Gas purification." Dec. 11.
27,818.—EWART, J. W., "Thermostat." Dec. 11.
27,834.—BRUNO, W., "Mantles." Dec. 11.
27,864.—WATERFIELD, J. G., "Gas-fired kilns." Dec. 12.
27,904.—BAILEY, W. E., "Gas heating, cooking, &c." Dec. 12.
27,978.—GORDON, W., "Photometrically testing burners." Dec. 13.
27,997.—DEMPSTER, R., AND SONS, LIMITED, and TOOGOOD, H. J., "Valves." Dec. 13.
28,002.—ERHARDT, A., "Photometers." Dec. 13.
28,008.—YATES, H. J., and DAVY, J. F., "Gas-controlling apparatus." Dec. 13.
28,009.—GAUTREAU, L. J., "Burners." Dec. 13.
28,010.—YATES, H. J., "Boilers." Dec. 13.
28,039.—WILLIDEN, H. P., "Making petrol gas." Dec. 13.
28,040.—STEPHENS, W. C., "Unions for cocks." Dec. 13.
28,052.—BECKMANN, J., and BEYKIRCH, F. A., "Strengthening mantles." Dec. 13.
28,153.—MILBOURNE, R. J., and BELL, J. F., "Gas-purifiers." Dec. 14.
28,186.—DUCKHAM, A. M'D., "Tar-pots or hydraulic mains." Dec. 14.
28,238.—COAN, R. W., and MARX, C., "Gas-burner rings." Dec. 15.
28,246.—BULL, A. F., "Turn-down gas-tap." Dec. 15.
28,250.—HALL, A. E., "Gas stoves or radiators." Dec. 15.
28,307.—INCANDESCENT LIGHT AND STOVE COMPANY and STUBBERS, J., "Gas-stoves." Dec. 15.
28,390.—MILLER, J., "Mantles." Dec. 16.

Gas-Fires and Gas-Steam Radiators.

Mr. Arthur Forshaw, M.Sc., of Messrs. John Wright and Co., has delivered at the Technical College, Glasgow, the second of a series of lectures to employees of the Gas Department and outside plumbers and fitters—taking for his subject "Gas-Fires and Gas-Steam Radiators." Bailie Kirkland, the Sub-Convener of the Gas Committee, who presided, remarked in opening the proceedings that the Gas Department were to be commended for organizing such lectures. The gas-fire was the most practical solution of the smoke problem; and he was glad to say such fires were now being ordered in large numbers, as the public were realizing their many advantages. In new departures of this kind, many lessons had to be learned; and it was, therefore, most essential that the appliances should be fitted in a competent manner, so that customers might get the best value out of the gas consumed. This was the reason why these lectures had been inaugurated; and he was certain they would prove of great educational value to their own staff, to outside plumbers, and through them to the gas consumers. The lecturer described the construction and qualities of gas-fires, and demonstrated common faults in fitting—showing where old types had been superseded or perfected. The high radiation efficiencies now obtained from gaseous heating, with the gas consumption for given duties, was likewise dealt with. A specially instructive part of the lecture was that with reference to flues and chimneys and the troubles caused by down-draughts. The construction and the proper use of gas-steam radiators or flueless heaters formed the second part of the lecture.

Mr. J. W. Ison, who has had many years' experience in the gas-stove business, both in this country and abroad, has been appointed London Representative to the Davis Gas-Stove Company, Limited.

MISCELLANEOUS NEWS.

MALLOW GAS PURCHASE ARBITRATION.

Second Day's Proceedings (continued).

The report is continued below of the proceedings in the recent arbitration at the Westminster Palace Hotel, S.W., to determine the price to be paid by the Mallow Urban District Council for the undertaking of the new Mallow Gas Company. The proceedings arose out of the Council's Act of 1910, which gave them power to compulsorily acquire the undertaking of the Company. The case for the Company was set forth in last Tuesday's "JOURNAL" (pp. 847-9).

Mr. C. C. HUTCHINSON acted as Arbitrator. Mr. HONORATUS LLOYD, K.C., and Mr. W. SZLUMPER (instructed by Messrs R. W. Cooper and Sons) appeared for the Company; Mr. VESEY KNOX, K.C., and Mr. A. M. PADDON (instructed by Messrs. Lees and Co.) represented the Council.

THE CASE FOR THE COUNCIL.

Mr. *William Newbigging*, examined by Mr. VESEY KNOX, said he had inspected the works and the agreed accounts. There had been very little change in the annual consumption during the last five years, notwithstanding that the charge to ordinary consumers had been gradually reduced from 6s. 3d. per 1000 cubic feet in 1905 to 5s. 3d. (and 5s. for cooking) in 1910. This showed that Mr. Anderson had worked the undertaking up as far as he could. The works were about a mile from the railway station, so that the coal had to be carted through the town, which was a source of nuisance to the inhabitants and of expense to the Company. As to the capacity of the plant, there was a surplus on some items, but a deficiency on others; and probably they about balanced. There ought to be another retort-bench and a duplicate engine and exhauster, and other smaller items needed attention. He had made a structural valuation of the works, buildings, plant, and machinery; and his valuation of the works was £3910, and of the distributing plant £1944. The latter included the meters and cookers. He had considered the revenue account for 1910, with a view to arriving at a right basis for his valuation. As to the management, he had proceeded on the footing that the Council were not in law bound to take over Mr. Anderson, though perhaps the Company might have been obliged to keep him. He had eliminated Mr. Anderson's personality altogether, and taken an ordinary manager. In other words, the bonus figures had been ignored. A suitable man could be found to manage the undertaking for £104 a year. Deducting £7 10s. already down for management (the residue, as Mr. Cash had pointed out, after the wages had been allocated between the different items of the revenue) there was left £96 10s. to be added for management. Then 5 per cent. depreciation should be allowed on prepayment and ordinary meters (£29), and 10 per cent. on stoves (£61); these amounts to be in addition to the figures for repairs and renewals shown in the accounts. He had allowed nothing for depreciation of fittings. The profit on fittings and coal (£85) were, however, deducted. The average price received for gas from the ordinary consumers was 5s. 0¾d. per 1000 cubic feet; and for his calculations he had taken the maintainable price as 4s. 6d. On this basis, the revenue would be reduced by £115. With lower prices there would probably be some increase in the ordinary consumption; and this he had put at 10 per cent., or a net value for the increase of about £20. The result of his calculations was to give a total reduction of £368 from the gross figures, which left a maintainable profit of £280. This he multiplied by 16⅔ years' purchase; and in doing so, he had taken into account the whole circumstances of the case. Being a non-statutory Company, he agreed that the position was insecure. He had put the matter on a 6 per cent. basis; and £6 2s. 6d. per cent. was what one could get by investing in the leading statutory company in Ireland—the Dublin Gas Company. The fittings profit he took at two years' purchase, because he thought this was the value of the business, which was open to competition by ironmongers and gas-fitters in the town. Three years was the figure usually adopted; but he regarded two as being quite sufficient. The coal profits he left out altogether, as he did not look upon this business as part of the undertaking purchased.

Cross-examined by Mr. HONORATUS LLOYD, witness agreed that the structural value of the works, which were in good order, was £5854; and he suggested taking them away from the Company for £4769. This, however, was because there was a very great difference between the structural and the commercial value. An undertaking might be worth far more structurally than it was commercially.

Mr. HONORATUS LLOYD: Is it true to say that the demand for gas is increasing?

Witness: No.

Think. The Urban District Council, your clients, proved it to Parliament for their Bill. Was it a lie?—I do not know about that. I am giving you my opinion.

And your valuation is based on that assumption?—Yes; that the demand for gas is not increasing.

It is shown clearly here: "Whereas the demand for the supply of gas within the district is increasing, and it is necessary and expedient that provision should be made therefor." That is for the increase. Is it true?—No; I do not think it is true.

The ARBITRATOR: Can Mr. Newbigging deny it? Is not that an admission on behalf of the Council?

Cross-examination resumed: He did not think there was any prospect of getting a profitable increased supply of gas beyond the present mains; and his valuation was based on the assumption that there was no increase, no demand for an increased supply, and no need for supplying the outlying districts. For a small works such as these, he thought the right figure to deduct in respect of repairs and maintenance of works, mains, meters, and stoves would be about 12d. per 1000 cubic feet of gas sold. In the Lisburn case, he claimed 7d. to cover everything; but the circumstances were altogether different from these. In the case of a transfer, he had never claimed more than 9d.; and he had never known a higher figure to be claimed. Also he had never had to do with works better maintained than these, or with conditions such as existed here—he meant in regard to the proportion of stoves to the output of gas. He had reckoned for the reduction in the price of gas on the ground that he wanted to do an act of justice to the ordinary consumers. If the Company had continued in existence, he thought the Council would have insisted upon securing a lower price for the public lighting, or would have given up the use of gas for this purpose altogether.

Mr. HONORATUS LLOYD: Oil has been open to them all these years, instead of resolutions. But they have preferred resolutions?

Witness: It would appear so.

Third Day.

Mr. *Newbigging*, further cross-examined by Mr. HONORATUS LLOYD, said the amended scale of charges for gas which he had put forward showed what he thought the Company could have earned if they had obtained their Bill; so that they would be statutory earnings. For statutory earnings in the case of an Irish company he would give 19 years' purchase. It was a fact that, though he had reduced the prices to what he called the statutory earnings, he had multiplied the result by 16⅔ years. But this was not a statutory company.

Mr. HORORATUS LLOYD: You cannot have it both ways. You cannot assume for the purpose of reducing their income that they are a statutory Company, and then for the purpose of security assume that they are not a statutory Company. You must surely treat them as one or the other?

Witness: I cannot assume they are a statutory Company.

Mr. HONORATUS LLOYD: No; but do not do it for the purpose of reducing their income, that is all.

Cross-examination continued: He did not know any gas undertaking, other than Dublin, in which one could invest to obtain a return of 6 per cent. He had ruled-out the coal business altogether, because he thought the Company had no power to carry it on. If, however, they were entitled to carry it on, it would be worth two years' purchase, the same as the fittings. He did not think the Company should have any allowance for disturbance, re-investment, &c.; but it was a matter for the Arbitrator to consider. The "disturbance" had been brought about by the Company's own proceedings.

Re-examined by Mr. VESEY KNOX: His structural valuation was on the basis of the original cost, without depreciation. The £280 was a profit which he believed the Company could make under statutory conditions; but they could not make more under non-statutory conditions. He applied the non-statutory multiplier, which he took to be 2⅓ years less than the statutory; but 2⅓ times £280 would not provide very much for the cost of obtaining the Bill. In fact, it would have cost more than the difference involved to secure the improved position. If the Company had come under statutory powers, they could not have obtained authority to carry on the sale of coal.

Mr. *Edward Fitzgerald*, a Solicitor practising in Mallow, replying to Mr. PADDON, said he had been Chairman of the Council for about six years and a member for ten years. He was also a large ratepayer, and owner of house property. Mallow was the reverse of a progressive place. So far as the quality and price of the gas was concerned, as long as he could remember there had been frequent complaints on the part of private consumers; and the Council had been repeatedly appealed to in their public capacity. He himself had noticed the wretched quality of the gas—especially after 10 or 11 o'clock at night. None of the resolutions prohibiting the Company opening the streets was ever enforced. The idea of the Council was to get better gas at a cheaper price. As to the charge of 3s. and 6s. each for openings in the roads, the explanation was as follows: Previously the Gas Company used to do the entire work of excavating and reinstating; and some members of the Council had their attention drawn to an opening in the town. It appeared that the yellow clay had been placed on the top, without macadam; and it subsided. It was thought that for the protection of the Council, they ought to undertake this work themselves; and they did so. It was reported that the price had been arranged between the Town Clerk and the Resident Manager. The Council macadamized the places where the Company had been excavating; and there was no profit to them on the work. He had never heard until he entered the room that the Company were retailing coal.

Mr. HONORATUS LLOYD (in cross-examination): The demand for gas is increasing, is it not?

Witness: Not very substantially. There are a number of people who would put it in if they had it cheap and it was good gas.

Mr. *Thomas Wrixon*, Clerk to the Council, examined by Mr. PADDON, said there had been a small decrease in the population of Mallow within the past ten years. Complaints as to the price and quality of the gas had been frequently made through him to the Company. Every time the public lighting contract expired, Mr. Anderson wanted to raise the price. The Council paid 37s. 6d. per lamp one year; but they refused to do so again. For the charges of 3s. and 6s. the Council in a number of places did the work of restoring the surface of the road.

Mr. PADDON: I have a letter from the Resident Manager at the gas-works addressed to the Town Clerk, and dated Nov. 24, 1905. It was on the subject of road-opening charges; and in the course of it the writer said: "I consider the present charges for service are excessive, but that for long jobs your charge of 6d. per yard is reasonable; and I respectfully submit that we should be put on a uniform basis of 6d. per yard for all trench work, with a minimum charge of 1s. per opening. Failing this, I am prepared to do the necessary repairs myself, and keep the trench in repair for three months from the date of opening, at this price. As December is our financial year, we are revising the working costs with a view to a reduction from 6s. 3d. to 5s. 10d. per 1000 cubic feet in the price of gas; and I respectfully ask that the Council will give early consideration to this matter, and facilitate our review."

Mr. VESEY KNOX: I need hardly say that, if I had known of this, I should have put it to Mr. Anderson, because it seems to place the thing quite beyond doubt.

Cross-examined by Mr. HONORATUS LLOYD, witness said the Company simply filled in the trench; and if they took a flag up and put it down again, they replaced it in such a manner that the Council had to re-lay it at their own expense.

Mr. VESEY KNOX (in re-examination): Did you consider from time to time whether you had the same power of destroying the Company as was used in the Fermoy case?

Witness: Of course, we knew we had the power; but we would not exercise it in Mallow.

You have always had the power; and you might have been forced to exercise it, if you could not have found another remedy?—Yes.

In Fermoy, I think, they stopped the opening of the streets absolutely, and in the end stopped the gas supply?—Yes, they did.

Mr. *John Lyne*, in answer to Mr. Paddon, stated that for 46 years he had been General Manager and Secretary to the Wexford Gas Company. He had thoroughly inspected the Mallow works, and agreed with Mr. Newbigging's evidence. There was no prospect of any considerable increase in the output of gas while the existing prices and conditions were maintained. At Wexford, he had never showed a profit on fittings and the work connected with them, taken together. The proportion of gas-stoves out on hire in Mallow was very large; and where there was an abnormally high percentage of stoves put out by a gas undertaking, he should think it would have a considerable effect on depreciation.

Cross-examined by Mr. HONORATUS LLOYD: Before he saw Mr. Newbigging's valuation, he had formed an opinion of his own, which was that the valuation should have been less. He could not remember now, however, what the amount was that he had in his own mind at the time. They were selling gas at Wexford at as low a price as the Gaslight and Coke Company. The capital was £14,400, on an output of 40 million cubic feet. In the case of many small undertakings in Ireland, the price of gas was much too high.

Mr. VESEY KNOX (in re-examination): You have tried to set up Wexford as an example; but you have not been received altogether kindly by some of the other managers?

Witness: As you say, not by some gentlemen. Certainly not by Mr. Anderson.

I think Mr. Anderson spoke of you as "a thorn in his side" once, did he not?—Yes; something like that. But I did not mind it. I have had my own customers in view. I have had no other object.

Mr. *Charles F. Spencer*, accountant, examined by Mr. PADDON, said that, jointly with Mr. Cash, he had prepared the agreed tables. As to depreciation, he thought a fair allowance for stoves would be 10 per cent., and for meters 5 per cent. For an undertaking such as that of the Mallow Company, he regarded 16⅔ years' purchase as a fair figure to adopt. Probably the Council would have to pay over 4½ per cent. for their money; and the difference between the security given by a rating authority and by a company of this description in raising capital would be equivalent to 1½ per cent.

Cross-examined by Mr. HONORATUS LLOYD: In this case the repairs and renewals over all works, mains, meters, and stoves came to 7·85d. per 1000 cubic feet, which compared favourably in the aggregate with other cases he had been in. He could not give any other company than the Dublin in which one could invest to get a return of 6 per cent. As to the Mallow dividends, the 10 per cent. had, in fact, been paid on the full capital issued.

The ARBITRATOR: What multiplier would you say to be the prevailing one in an ordinary business dealing with fittings?

Witness: Where there is a great deal of competition in this class of business, I should say three years is the maximum multiplier.

And where the competition is diminished?—Where the competition is diminished, I should increase it to four years.

With regard to the coal business, what would you say? In taking over any coal business, how many years would you give?—In any case I should say five years.

And if the competition were diminished by some circumstance—say, that the man was selling coal, and he was enabled to compete better than others by reason of the fact that another business he worked along with it enabled him to sell a superior quality of coal at the same or a lower price?—I think there he would be entitled to 50 per cent. more, or seven-and-a-half years.

SPEECH FOR THE COUNCIL.

Mr. VESEY KNOX, in his address for the Council, said that Mallow was not an increasing town; and, according to any English standard at least, it could not be described as other than a poor town, and one likely to remain poor. As to the Gas Company, Mr. Anderson had every motive for keeping the price high, and for writing-off nothing for depreciation, because he got, in addition to his dividend, a bonus in proportion to the gross profits. On the basis of the prices charged, the undertaking had reached its zenith, and could not have been further increased. It had been urged on the other side that the lack of growth since 1906 was due to insecurity; but this was absolutely unsupported by the facts. During the very period when Mr. Anderson said he was suffering from insecurity, he was enormously increasing the capital of the Company. Really, he had been rather struck by the change of attitude of his learned friend in the course of the case, on this question of insecurity. He said deliberately that this was a charge levelled with a meaning. It was invented to explain the want of development—an invention to show that the increased sales would have been greater if it had not been for the conduct of the Council—and it was proved, on being looked into, to be absolutely and entirely an unjust charge. What he ventured to suggest as the true explanation was that the Council took what steps any peaceable council could take who were not prepared to go as far as the Fermoy people did. They were charged a very high price; and they made a quite reasonable road charge. The "prohibiting" resolutions were never acted upon; but at last, in 1909, they came to a point when they said they could not go any farther. They had then the choice of two courses. They could either do as Fermoy did, or they could ask for power to purchase. The latter was exactly what Mr. Anderson all through had been playing for. He had refused to reduce the price of gas for public lighting year by year, because he wanted to force the Council to buy. Instead of this being the case of a company whose undertaking was compulsorily acquired, in its essence it was much more like the case of a council being made to purchase. The course which Mallow took was one which ought to be commended rather than that of Fermoy. But when fixing the sum to be paid, the Arbitrator had to take into account whether or not the gas prices (which, if the concern had gone on, would have led to a Fermoy policy) were prices that should be capitalized and placed for ever upon the backs of the consumers of Mallow. Coming to the actual points in controversy between the expert witnesses, he did not think there were really very many of them, though each item was of importance. He did not propose to discuss the question of surplus works, because the Arbitrator had been to Mallow, and could appreciate the evidence. But there was a second reason for not going into this matter. Having regard to the slow development of the undertaking, there was no justification for supposing that there was any value, either to the seller or the purchaser, in whatever surplus works there might be. It was a luxury that had no mercantile value. It perhaps secured a little better the rest of the enterprise; but this was the most that could be said for it. Thus, he suggested that Mr. Newbigging's view was a fair one—that nothing should be deducted for deficiencies, and nothing should be added for surpluses. As to structural value, there was no great variation between the different witnesses, without allowing for depreciation. The true basis of valuation was the maintainable profit; and on the side of expenditure there were only two items in conflict. One was the proper allowance for depreciation, and the other the correct charge for management. On the point of depreciation, his learned friend had it in his favour that the charge of something under 8d. per 1000 cubic feet which was put in the accounts for repairs to meters, stoves, works, and distributing plant, was not a low figure when compared with many other cases dealt with in arbitrations. But, on the other hand, it was a very low figure when compared with what the Company had had to spend in past years; and he suggested that, having regard to what they knew of the conditions in the South of Ireland, it was not safe to take a lower amount than the one which had been actually spent by the Company for the works and mains. Therefore they had to deal with the question of whether the allowance for stoves and meters could be anything like sufficient. There was an unusually large proportion of stoves in Mallow. The fact that they spent a very much larger sum in previous years, might well have enabled them to spend a smaller sum in this particular year; but it did not follow that it was going to be always so, or that they were going to keep down to this figure as the average. It was rather a reason to suggest that the figure of the last year was not a safe guide to take. In fact, he submitted that there was no sort of adequate provision for depreciation of meters and stoves, and that an allowance for this should be made. As to the agreement with Mr. Anderson, this seemed to bind the Company as long as Mr. Anderson lived and the Company paid a 5 per cent. dividend; and he could not think that an agreement such as this came within the scope of the clause in the Bill which made agreements binding upon the purchaser. But he was not quite sure that it made any difference whether it did or not, because what they were valuing was the worth of the undertaking to the Company; and the value of the undertaking to the Company was its value saddled with Mr. Anderson's agreement, or with the advantage of Mr. Anderson's agreement, whichever way they cared to put it. It seemed to him to be an agreement which would only have continued, in one form or another, so long as it was to Mr. Anderson's advantage. If they had had a strict auditor who wrote off a proper sum for depreciation, and if they had had a Board who were constantly wanting a lower price, and if the price had been lowered and the profit thereby reduced, it would have been to Mr. Anderson's advantage to bring it to an end. On the basis of value which the Council were putting forward, the agreement was worth nothing to Mr. Anderson, because he got nothing under it beyond his £25 until the profits of the Company exceeded £340. If the Company had gone on, they would sooner or later have had to allow for depreciation and to alter the price.

Mr. HONORATUS LLOYD: The moment Mr. Anderson's agreement goes, he loses his bonus; and you may apply the whole of the bonus to depreciation.

Mr. VESEY KNOX: Not the whole of it, because you would have had to substitute another manager. In effect, it was an agreement which stood so long as the profits divided out of the undertaking were swollen in the way they were—as the Council said, illegitimately. Thus he was entitled to claim that the whole of the bonus should be taken into account if the present position was maintained; while if the existing profits were not maintainable, then they would have to face the question of what it would cost to manage the concern supposing the agreement had come to an end. In this connection he thought the figure which Mr. Newbigging had deducted as the cost of management was amply supported. No doubt his learned friend would claim that he had made good his case with regard to the £1000 which he urged as being the value of the possible saving when Mr. Anderson's agreement came to an end. But this was one of the most hypothetical claims ever put before an arbitrator. A sounder method was that of finding what was really necessary to manage the concern properly from the first, and putting it on this basis. He took it as almost beyond argument that coal and fittings ought to be deducted in the first instance before arriving at the value of what might be called the monopoly undertaking. For fittings, three years was what he had generally seen put down in these cases; and he did not see himself why it should be put at much less. As to coal, this was no part of the Company's legal undertaking. It was not within their Memorandum of Association; and in any case when they went to Parliament for statutory powers, authority to sell coal would not have been given them. Therefore nothing ought to be allowed for coal. The next point—that of maintainable prices—was in some ways the most difficult, as well as the most important, one in the case. But he thought sooner or later the ordinary charge (which averaged 5s. 0¾d. per 1000 cubic feet would have had to be brought down to the same price as the slot-meter consumers were paying (4s. 10¾d. per 1000 cubic feet), and that Mr. Newbigging was well within the mark when he claimed that it would have to be lowered to 4s. 6d. per 1000 cubic feet. The public lighting also ought to be reduced to at least the same figure. The last point was the multiplier. There was strong evidence to show that a 6 per cent. basis was the right

one in this case. They were taking over a concern without any working capital at all. Finally, as to the question of the 10 per cent. allowance. Having regard to the whole history of this concern, he ventured to suggest that nothing at all ought to be allowed for compulsory purchase. He would now leave the case for the Council in the hands of the Arbitrator, with the earnest hope that he would not award a sum which would permanently lay too heavy a burden on the people of Mallow.

Fourth Day.

THE REPLY FOR THE COMPANY.

Mr. HONORATUS LLOYD, in the course of his reply on behalf of the Company, said that, with regard to Mr. Anderson's agreement, it did not seem to matter much which contention was right, because the figures worked out very much the same either way. With regard to coal and fittings profits, he was inclined to think that the method adopted by Mr. Woodall—of eliminating them from the general undertaking and dealing with them separately, for the purpose of capitalizing—was the more correct one. He was, however, a little doubtful about it, because there was much to be said for Mr. Jones's principle. He therefore started by taking the £85 10s. from the £648, the balance of profit for the year ending Dec. 31, 1910. As to depreciation, did not the evidence tend to show that, though in the account year the repair and maintenance figure in respect of meters and stoves might be insufficient in itself to cover depreciation, if the variations were considered that must occur from year to year in works, mains, services, meters, and stoves together, there was sufficient give and take between one item and another to cover the whole? Even making allowance for the exceptional proportion of stoves in the present case, the total figure shown in the accounts was a very fair one. The whole difficulty arose here from what he ventured to think was a little unfair criticism in selecting one particular item and ignoring the abnormally high allowance in respect of the others. Coming to the question of management, Mr. Newbigging under this head made a net deduction of £96. But the Manager would be able to do the secretarial work for which Mr. Anderson now received £25; so that the net deduction should be £71—giving a maintainable profit of £491 down to this point. With regard to the suggested reduction on account of the excessive charge for gas, he quite agreed that it was not usual to see on the face of an account that the ordinary consumers were paying more per 1000 cubic feet than the users of prepayment meters, and that it was also not customary to find that the public lighting price was more than either. But, of course, local conditions had to be taken into consideration. Was the ordinary price of 5s. 3d. per 1000 cubic feet excessively high? Judging from prices ruling with similar undertakings in Ireland, it was not. The price for public lighting did seem high in comparison with the others. But here, again, there were a great many things that had to be taken into account. First, gas was only wanted for the lamps during the winter months—at the time of the biggest demand on the undertaking—and it was necessary to provide plant and meet administration expenses all the year round, though the lighting was only required for a portion of it. Of course, they could not expect to be supplied with gas during the time of the peak-load, and to take no supply whatever during the summer, upon the same terms as people who took a more continuous supply. There was evidence that the price for the private consumer was not unreasonable; and, with the exceptional circumstances, there was no reason for suggesting that the public lighting charge could not be maintained in the future. If this were so, any proposed reduction of profit on account of excessive price fell to the ground. In the matter of the number of years' purchase, he was going to submit that perhaps Mr. Jones's figure of 22 years was nearer the mark than Mr. Woodall's 25 years. It had been said that they could invest in Dublin gas stock to return 6 per cent.; but Dublin was an exceptional case. In arbitrations, these 6 per cent, 5½ per cent., and 5 per cent. investments were always flaunted about; but if a would-be investor produced his cheque-book, he could not get them. He found that if he could buy at auction to return him £4 12s. per cent., he did mighty well. With reference to the question of an allowance for compulsory purchase, it was the duty of the tribunal to see that the vendor who was compelled to part with his property should not suffer by the transaction. Like his learned friend, he would not deal with the surplus works, because the Arbitrator had been to Mallow, and had the evidence before him. The profit on fittings was a small matter, which the different witnesses had put at from five years' to two years' purchase. As to the coal profits, however, a different point had been raised on the other side. The undertaking which the Council were to buy was defined by the Act under which they purchased. This very clearly included the coal business as carried on by the Company. It was true that, in terms, it was not included in the Articles of Association; but if there was a difficulty, it was merely a technical one. The Company asked for five years for both fittings and coal profits—or £430 together. In conclusion, he must say that he regretted his learned friend should have thought right to suggest that Mr. Anderson had wilfully tried to mislead the tribunal. This observation seemed to have arisen from the fact that Mr. Anderson said that, so far as he knew, there was absolutely no foundation for a suggestion that there had been any arrangement that the Local Authority should charge either 3s. or 6s., or any other sum, in respect of the opening of the streets. Mr. Anderson told them, so far as he knew, the whole truth—he had made no such arrangement. In accordance with his instructions, the filling-in was done by the Company's own men; and he was as ignorant as the Council themselves seemed to be of the existence of a letter which showed that the Resident Manager had made some arrangement with the Local Authority. "You have the facts," said Counsel finally, "that now there is a supply given of gas to practically everybody who wants it—that is to say, that the people have taken it at the prices which Mr. Anderson and his Company have thought fair; that in respect of private consumers the complaints have been infinitesimal; and that the amount extracted and paid to the shareholders has been such as to enable the works to be kept in an absolutely good state of efficiency. Then it is, and then only, when this state of efficiency has been arrived at, that the Local Authority, who lay by callous while the old Company went to the dogs, and the gas supply was apparently going there too, come forth and say: 'Now is the time we should grasp these people. Now the harvest is ripe. The hard work has been done; the works are in excellent order; let us step in. But let us tell the Arbitrator that our means are such that he ought to be careful, and let us off as easily as he can.'"

TYLDESLEY GAS-WORKS EXTENSIONS.

New Water-Gas Plant Installed.

In the presence of the members of the District Council, representatives of neighbouring local authorities, and gas engineers from various parts of Lancashire, the new water-gas plant which has recently been installed at the Tyldesley Gas-Works was formally brought into use on the 16th inst.

The Chairman of the Gas and Water Committee (Mr. G. Brown) stated that the local gas undertaking was for many years burdened by troubles arising from the subsidence of the works, but he was glad to say that these difficulties had now been successfully overcome. Their present consumption of gas was about 52 million cubic feet per annum; and during the last eleven years it had increased by about 40 per cent. The carbonizing plant was equal to about 250,000 cubic feet; but the highest day's consumption was 300,000 cubic feet. Fortunately their storage was adequate—the capacity being about 400,000 cubic feet; but it would be seen that there was no reserve of manufacturing power. Under these circumstances, they had either to put in more retorts or have water-gas plant. For several reasons they decided on the latter alternative. For one thing, they did not consider it advisable to increase the number of retorts, because of the liability of the land to subsidence; and they were influenced in favour of carburetted water-gas plant because of the ease and rapidity with which it could be brought into operation. The new plant, which had been erected by Messrs. R. & J. Dempster, Limited, of Manchester, had increased by 50 per cent. the manufacturing power of the works. It had a nominal capacity of 120,000 cubic feet per day; and in the trials that had taken place the actual production was between 150,000 and 160,000 cubic feet.

Mr. Knight, Messrs. Dempster's representative, remarked that, under the conditions obtaining at Tyldesley, the Gas Committee's then Engineer (Mr. H. R. S. Williams) had shown sound judgment in deciding to adopt the carburetted type of water-gas plant. After describing the process of manufacturing the gas, Mr. Knight remarked that this was the first plant erected by his firm in which everything connected with it was worked from the ground floor; and its operation was most simple and effective.

Mr. Brown then started the plant by turning on the steam to produce the gas, and Mr. Brimelow, the Chairman of the Council, admitted the oil for its enrichment.

GAS SUPPLY FOR KIDWELLY.

Opening of the Gas-Works.

In the course of the past twenty-five years, several attempts have been made by the Corporation of Kidwelly—one of the oldest towns in the Principality of Wales, possessing a Charter dating back nearly a thousand years—to light the streets. Various illuminating agents—gas oil, paraffin oil, and acetylene—have, in turn, been tried, but without much success. About eighteen months ago, Messrs. Willey and Co., Limited, were introduced to the Council, and, after some preliminaries, the firm secured the right of erecting gas-works and laying pipes in the streets. The works were duly completed; and last Tuesday morning they were formally opened. On the invitation of Messrs. Willey, the Mayor (Mr. David Rowlands) and the members of the Corporation, together with several friends, attended at the works and were shown over them. Among the company were Mr. C. Pipe, the representative of Messrs. Willey and Co. for Wales; Mr. S. Davies, their Swansea Manager; Alderman W. N. Jones, the Chairman, and Mr. Hubert Russell, the Engineer and Manager, of the Ammanford Gas Company; Mr. Harold Barker, the Manager and Secretary of the Llanelly Gas Company; and Mr. H. Versey, the newly-appointed Manager of the Kidwelly works. The process of making gas was explained by Mr. Harry Groves, the firm's Engineer; and then Mr. F. Templer Depree, the Chairman, asked the Mayor to turn on the gas and declare the works open. This having been done, the company assembled in the retort-house, where they were entertained. Mr. Depree gave a brief account of his firm's connection with Kidwelly, and of the negotiations which resulted in the erection of the works. At the close of these remarks, the Mayor proposed the health of Messrs. Willey and Co., and wished the enterprise every success.

The works were designed by Mr. Groves. The buildings were erected by Messrs. Joseph Denham, of Bishop Auckland and Newport; and Messrs. Hannay Bros., of Swansea, were entrusted with the laying of the mains. The result of their combined efforts has been the production of thoroughly up-to-date works. There appears to be every prospect of the undertaking being a great success, as already nearly every private house and business establishment is taking a supply of gas; and a number of gas-cookers have been installed.

Gas for the Smoke Abatement Exhibition Next Year.—We learn from Mr. F. W. Bridges, the Organizing Manager of this exhibition, that the Directors of the Gaslight and Coke Company have agreed that the price for gas used there shall be reduced to 2s. per 1000 cubic feet. This concession of 7d. will, Mr. Bridges says, be much appreciated by those members of the gas industry who are participating in the exhibition; and, taken in conjunction with the fact that the Company have secured a large space for the demonstration of the advantage of gas for various purposes, it may be regarded as an indication of their practical sympathy with the objects of the exhibition.

THE LIGHTING OF GUILDFORD WORKHOUSE.

A Defeat for Electricity.

At a Meeting held on last Saturday week, the Guildford Board of Guardians rejected, by a majority of two to one, a scheme for the lighting of the workhouse premises by means of electricity. As the result of various discussions, the Visiting Committee were last June instructed to go thoroughly into the question of the cost of lighting both by gas and electricity. They appointed a Sub-Committee, who were empowered to call in the assistance of Mr. E. Lancaster Burne, Assoc.M.Inst.C.E.; and the upshot of the inquiry was that the Board were recommended to substitute electricity for the present system of gas, at an estimated initial expenditure of £600. The Sub-Committee pointed out that their guiding principle had been to recommend the illuminant which, in their opinion, was the cheapest, having due regard to efficiency. The following is a summary of their report.

(1) Mr. Lancaster Burne, in his report, stated *inter alia* that 460 lamps of various candle power would be necessary, and that, with the most lavish use, the annual consumption of current was never likely to exceed 9000 units. If, however, reasonable economy in switching-off unnecessary light was exercised, he considered the consumption would probably be nearer 7000 units. The Sub-Committee, in their calculations, estimated the annual consumption of current at 8000 units. The actual cost of wiring the premises, including all lamps and fittings (the latter of plain design, but substantial and of good quality), he estimated at from £500 to £600. Of these two estimates, the Sub-Committee adopted the latter. In conclusion, he pointed out that he had confined himself entirely to commercial considerations, and had not put forward the superior claims of electricity in regard to cleanliness and safety. He added that these undoubtedly merited some attention—an opinion which the Sub-Committee fully endorsed.

(2) The following statement showed the cost of gas consumed at the workhouse during the five years ended at Michaelmas, 1911: 1907, £277; 1908, £284; 1909, £280; 1910, £308; 1911, £334—total, £1483.

(3) Mr. William Titley, in an interview, stated that the Gas Company would be prepared to reduce their charge for gas to 2s. 6d. per 1000 cubic feet net, provided the annual payment for gas was never less than £250. The present charge worked out at a little over 2s. 7d. per 1000 feet. He also advocated the use of governors and the substitution of incandescent lights for the remaining flat-flame burners, which, he stated, would effect a considerable saving.

(4) The Electricity Supply Company submitted the following estimate, based upon a consumption of 8000 units per annum: 4000 units at 6d., £100; 4000 units at 3d., £50; annual instalment of cost of installation, £60; lamp renewals and maintenance, £15; meter charges, £2; total annual charge for first ten years, £227; total annual charge afterwards, £167. Mr. Alderton, in an interview, estimated the total cost of installation at £600, and stated that his Company would bear the initial cost; the Guardians to repay the same in ten annual payments, free of all interest—the Guardians themselves to obtain tenders and accept the contract for carrying out the work, the Company preparing the necessary specifications free of cost. The Company would enter into an agreement, he said, to maintain and renew all lamps (which would be metallic filament) for an annual charge of £15.

With regard to Mr. Titley's recommendation relative to the adoption of governors, the Sub-Committee stated that governors had been tried and discarded; and they considered no saving would be effected by substituting incandescent for flat-flame burners. There only remained the question of the reduction of the price of gas; and, taking the consumption for the year ended Michaelmas, 1911, it worked out as follows: 2,307,900 cubic feet at 2s. 6d. per 1000 feet net, £288 9s. 9d. maintenance, £17 8s.; rent of meters £5 9s.; rent of cookers, £1—total, £312 6s. 9d.

The adoption of electricity as an illuminant would still necessitate the use of gas for cooking; and the cost of this, at 2s. 9d. per 1000 cubic feet, was estimated at £70 per annum, including rent and hire of meters and cookers. The cost of the two methods would therefore be: Gas, £312 6s. 9d.; electricity, £227, *plus* gas-cookers, &c., £70—£297. The adoption of electric light would therefore at once effect a small saving of about £15, and after ten years a further saving of £60 per annum—making a total annual saving of about £75. To this must be added a distinct saving in decorations, &c., due to the greater cleanliness of electric light; and it was reasonable to suppose that an ultimate saving of about £100 per annum would be effected. The Sub-Committee felt bound to recommend the adoption of electricity as being more economical; gas being retained for the cookers. This recommendation had only been made possible by the exceptionally favourable terms offered by the Electric Light Company—terms which it would be quite impossible for the private consumer to obtain.

The discussion was a long one, and many points were raised—cleanliness, wholesomeness, fire risks, asphyxiation dangers, and what not; but the arguments were mainly on the question of figures. One member maintained that by the adoption of gas-governors and incandescent burners, a saving could be effected on the present expenditure; while several others expressed doubt as to just what was intended to be included in the estimate of £600 for the cost of the electrical installation, and as to whether the estimated consumption of current would ensure a light equal to that provided by the existing gas installation. The critics should have been crushed—but they were not—when a supporter of the electrical scheme described their criticism as "fatuous." So little affected were they, indeed, by this indictment, that one speaker even ventured subsequently to quote an instance of "a trader in Woking who had replaced electricity by gas, and had reduced his expenses by one-half." After the electricity proposition had been turned down, it was decided to obtain an estimate of the cost of fixing a gas-governor.

A fire, which destroyed the building and did much damage to the generating plant, occurred recently at the Topsham Electricity Works.

Greetings.

WE again offer our Season's Greetings to all who have so generously assisted us in making our business for 1911 another record.

The New Year will be one of keen competition between Gas and Electricity, and we are prepared, as in the past, to co-operate in every effort put forth to advance to the full the legitimate aims of Gas in all its Branches.

THE
RICHMOND
Gas Stove & Meter Co., Ld.
GAS APPARATUS SPECIALISTS,
132, QUEEN VICTORIA STREET, E.C.
and ACADEMY STREET, WARRINGTON.

STOCKPORT CORPORATION WATER-WORKS.

Completion of the Kinder Scheme.

The large storage reservoir which has been constructed in the Kinder Valley for the Stockport Corporation is now being filled, and contains already upwards of 200,000 million gallons of water. The formal opening will not, however, take place until the tests for possible leakages have been completed, and everything is found satisfactory. The work, which is now practically finished, was commenced in 1907 under administration, after a good deal of litigation and a revision of the original scheme of 1900 for improving the water supply of the borough. For the masonry dam, which was part of the first scheme, an earth dam was to be substituted; and for this it was found necessary to take the foundations 200 feet below the natural ground level. The dam, which now stretches across the valley, has been completed in record time; and it is said to be one of the highest earth dams in the world. The bank is composed of a puddle core 28 feet at the base and 6 feet at the top. It is faced on the water side with stone, and on the down-stream side with 9 inches of soil and grass. It is 120 feet high, 600 feet wide at the base, and 14 feet wide at the top; and it is 1158 feet long. The bank is curved, presenting a convex face to the water. On one side of the valley, it was found necessary to put in a wing trench, turning at right angles to the main trench on the north side. This trench is 570 yards long, and had to be excavated to a depth of about 215 feet, and filled up with concrete. The most difficult part of the work has been the trenches. No fewer than seven faults were discovered in the strata; and at one time it seemed doubtful whether a water-tight foundation would be obtained. Mr. Basil M'Kenzie has the management of the scheme; and the Engineers are Messrs. G. H. Hill and Sons.

NORTHALLERTON WATER SUPPLY.

An Auxiliary Scheme.

An interesting water scheme is now being proceeded with at Northallerton, in order to augment the supply obtained from the existing works, authorized in 1891. The following particulars of the scheme were given recently in the Engineering Supplement to "The Times."

Some years ago, adits were constructed in the hill at Barrowby, and endeavours were made to tap water from springs in the Cotcliffe Wood. But the water thus obtained gradually fell short of the estimated total required; and as a result of the further exploration of the Cod Beck Valley, additional springs and streams of exceptional purity were discovered which gave a daily supply of 120,000 gallons. When parliamentary powers for this scheme were sought, the riparian millowners below the points of abstraction contended that they required equally bright water for bleaching purposes, and provision was therefore made that the flow along the bed of the stream should not be reduced during drought; and it was enacted that 120,000 gallons daily should be sent down the stream, so far as practicable. To comply with this proviso, it was necessary for the Northallerton Urban District Council to construct a reservoir containing 15 million gallons, equivalent to about 120 days' supply, with a bye-pass conduit to intercept the dry-weather flow of the Cod Beck and the Slapestones Beck before entering the compensation reservoir. As a means for further securing bright water to the millowners, the reservoir is provided with an iron tower fitted with three valves at different elevations, so that when the flow in the bye-pass conduit falls short of 120,000 gallons daily, the water may be drawn off and sent down the Cod Beck to supply the bleach works.

It has been necessary to construct another valley reservoir about a mile eastward of the village of Osmotherly and seven miles from Northallerton, in order to provide additional water for compensation and for the town. The scheme in hand will provide 275,000 gallons a day, inclusive of the 120,000 gallons required by riparian owners; and the whole of it will be obtained from the dry-weather flow. A bye-pass conduit will be constructed to intercept bright water for the millowners. It will thus be seen that the ordinary method of supplying compensation water is reversed, as, instead of the town taking the very clearest water from the streams during the times of drought, it will be dependent upon the valley reservoir, in which the floods and freshets from the valley are to be stored. So long as there is sufficient bright water for the millowners, but not otherwise—that is, when the millowners' supply falls short of the statutory amount of 275,000 gallons daily—it has to be made up out of the reservoir. Self-acting recording instruments will be fixed to register the water sent down the stream below the reservoir, and also that which is taken for town purposes. The quantity sent down the stream will be equivalent to the amount taken for the town supply.

The gathering-ground of the whole of the works is 1234 acres; and the new reservoir will intercept the rainfall from about 640 acres of this area. It will be 726 feet long, and its embankment will be 330 feet long and 46 feet high. There will be an iron tower inside the reservoir away from the embankment. It will be 46 feet high and 5 feet in diameter inside, and constructed with a vertical iron pipe fitted with three valves at various levels, so that the water may be drawn off in as clear a condition as possible.

The works are being carried out according to the designs and under the direction of Mr. A. M. Fowler, of Manchester; and the total cost when completed is estimated at £17,100.

The Gas Committee of the Heywood Corporation have under consideration a scheme for the reconstruction of the retort-house, which will probably include an installation of vertical retorts, regarding which the Gas Engineer and Manager (Mr. W. Whatmough) has compiled a great deal of information for the members of the Committee.

FUEL AREA and CANOPY CAPACITY.

¶ Our Fires have the largest fuel areas, but it does not follow, as those who are perturbed at our recent announcements would have you believe, that the products of combustion are also the largest—too large for the canopy to deal with.

THE "SYMMETRICAL."

¶ The products of combustion depend upon the amount of gas consumed. Our Fire consumes less gas, size for size, than any other Fire, and it follows that, although the fuel area and radiating efficiency are greater, the products of combustion are less.

¶ Our canopy has beauty of contour, is in perfect proportion to the size of the fire, and is amply large enough to deal with the fumes. As we can vary the size of the flue nozzle, according to the conditions obtaining, our Fires are absolutely HYGIENIC.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes St., Oxford Circus, W.; 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER; 8, Exchange Place, Donegall St., BELFAST; 333, Queen St., MELBOURNE; and 12, Cunningham Lane, Pitt St., SYDNEY, N.S.W.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On the silent wings of time we have drifted down till it now devolves upon me, according to practice, to recall some of the leading incidents we have passed through in the year which is about to close.

There is always a considerable change in the *personnel* of a body like gas managers. In 1911, the number was not very large. Mr. J. Mitchell resigned at Ardrossan, and became Assistant to Mr. A. Yuill at Dundee. The vacancy at Ardrossan was filled up by the appointment of Mr. J. D. Keillor, of Lochgelly, who was succeeded by Mr. W. Ewing. Mr. James Paterson, of Langholm, died in February, and was succeeded by Mr. Peter Macdougal, who was followed in August by Mr. A. M'Nair. Mr. W. M'Cowie, Lockerbie, died in November, and was succeeded by Mr. J. A. Robertson, of Polmont, who was followed by Mr. Robert J. Philp, of Dunfermline. Mr. W. M. Williamson, of Oban, in May succeeded Mr. W. Young at Penicuik.

Reductions in price were common; and there are now some wonderful results—such as gas being sold in Aberdeen for motive power at 1s. 11d. per 1000 cubic feet. It is difficult, on account of the working of discounts, to find out with accuracy where the cheapest gas is to be obtained; but the charge of 1s. 6d. per 1000 cubic feet for motive power at Coatbridge seems to be about the lowest in Scotland. When discounts are taken into account, there are exceedingly low charges at Alloa, Hamilton, Perth, and Dundee. So far as I can make out, the only place where gas is sold to ordinary consumers at less than 2s. per 1000 cubic feet is Johnstone, where the charge is 1s. 10d.—reduced to 1s. 9d. if more than 100,000 cubic feet are consumed.

The price of coal has risen during the year. When the year started, the quotations were:

	Ell. Per Ton.				Splint. Per Ton.				Steam. Per Ton.			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan.	9	9	10	3	10	6	10	9	9	0	9	3
April.	8	9	9	9	9	9	10	0	9	0	9	6
July	8	3	9	9	9	3	9	6	8	9	9	0
Oct.	9	6	10	6	10	3	10	6	9	3	9	6
Dec.	11	9	12	6	12	6	12	9	11	0	11	3

When the year opened, the Paisley Corporation had just inaugurated an extension of the retort-house equal to over 26 per cent. of its capacity. The Kirkcaldy Gas Arbitration commenced in Edinburgh in the second week. It was of a prolonged nature, and ended in an award in favour of the town for £137,150—a price which, when adjusted, amounted to almost £10 per share.

Very successful and agreeable annual meetings were held of the Waverley Association of Gas Managers at Edinburgh in June; of the Institution of Gas Engineers at Glasgow in June; and of the North British Association of Gas Managers at Glasgow in September, at all of which more than ordinary interest was taken, and more than usual provision was made for explaining the new process of carbonizing coal in vertical retorts. The members of both Districts of the Scottish Junior Gas Association continue to prosecute their calling with great vigour, and with much benefit to themselves.

In the course of the year, there have been two litigations, both of which are to be regretted. The one had reference to the value of shares in the Cowdenbeath Gas Company; the principal difficulty in which seemed to be that an agreement had been drawn up between the parties with reference to the holding of shares, which was a great deal more strict than was necessary. In the other case, a member of the governing body in the gas supply of a burgh was prosecuted for alleged misappropriation of gas. The prosecution was brought in two different ways, and failed in both. Probably neither of the litigations is yet out of the way, because they may be taken to Higher Courts for final decision. There is also pending before a branch of the Court of Session a question relating to the valuation of gas-works, which are owned by the Edinburgh and Leith Corporations. They maintain that, under recent decisions, they are entitled to deduct the amount of landlord's taxes and feu duties.

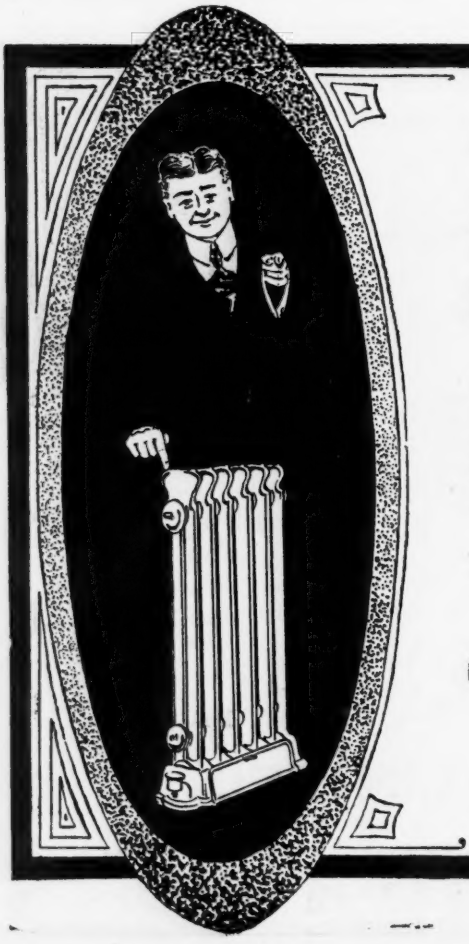
Towards the end of the year, a question arose as to the measurement of stocks in the Peterhead Corporation gas-works. The quantity of coal represented had been certified by the Auditors, but afterwards challenged. A special remit was made for inquiry, as a result of which the measurement was found to be inaccurate; and the year has closed without the party making the complaint being satisfied.

A very successful exhibition of gas appliances was held in Aberdeen in the autumn, as a result of which many gas fires and cooking appliances have been adopted by householders in the Northern City.

During the year, the Corporation of Fraserburgh acquired, by arbitration, the undertaking of the Fraserburgh Gas Company.

The Edinburgh and Leith Gas Commissioners held their last meeting for 1911 this week—a week earlier than usual.

The subject of the working of the Peterhead Corporation gas undertaking is again to the front. The report by Messrs. Meston and Co., Chartered Accountants, of Aberdeen, had been procured and published in the local Press. These gentlemen explained their report, and went on to say that the annual statements of results submitted to the Town Council after the close of each financial year showed serious discrepancies compared with the respective amounts subsequently published. A letter from the Scottish Office dated Dec. 12 was also submitted, in which it was pointed out that, in view of statements made by certain speakers at a meeting of the Town Council, it did not rest with the Scottish Office to approve or disapprove of the report obtained from Messrs. Meston in regard to the gas undertaking. On perusing the report and explanations, it was seen that they confirmed the criticisms passed by that Department on the gas accounts; and consequently the Scottish Office letter of Sept. 22 last was sent to the Town Council. In reply, the Secretary for Scotland was informed by the Council, on Oct. 4, that certain reforms would be introduced in relation to the



You do know this:

THAT Davis's Steamless Radiator has, in a remarkably short space of time, attained widespread popularity, not only in this country, but in the Colonies and wherever gas is used. But WHY?

BECAUSE the "Steamless" gives exactly the same results as the best steam and hot water radiators with increased ECONOMY. It is economical to INSTAL, to MAINTAIN, in GAS CONSUMPTION——and in LABOUR, because it requires NO ATTENTION.

BECAUSE it conforms to all the MAINTENANCE ideals of Davis Specialities.

BECAUSE absolute confidence is engendered by the THREE YEARS' GUARANTEE which accompanies every radiator sent out.

We hold a big stock of all standard lines, and can despatch instantly.

THE DAVIS GAS STOVE CO., LTD., LUTON.

management of the gas undertaking and the accounts of the burgh; and it rested primarily with the Town Council to see that these reforms were of a satisfactory and effective nature. The subject is to be again before the Town Council this week.

In connection with the strike of carters in Dundee, inquiries were made as to what the effect of the trouble might be in regard to the coal supplies to the gas and electricity undertakings. It was ascertained that at the gas-works there was about a month's supply of coal on hand; and the officials in charge considered themselves fully prepared for the emergency which had arisen. A similar state of matters was found to exist at the electricity station.

A new gasholder which has been erected for the Huntly Gaslight Company was brought into use on Monday last. The increasing demand for gas has of late taxed the Company's plant to the utmost; and at the end of last season the Directors recommended the construction of a two-lift holder, of a capacity of 47,000 cubic feet. The new holder has been built to the specification of Mr. Samuel Milne, Gas Engineer, Aberdeen. The Contractors were Messrs. Hanna, Donald, and Wilson, of Paisley.

Newcastle Public Lighting.

At a meeting of the Newcastle-on-Tyne Lighting Committee last week, the annual report was presented. It stated that the estimated cost for lighting 9021 gas-lamps in the city for the coming year was £25,542, including cost of maintenance, £1235. The estimated cost of the electric lamps was £6007, for 827 lamps. Last year, the cost for lighting 8884 gas-lamps (including maintenance) was £25,403, and the cost for electric lighting was £5962, for 807 lamps. The Lamp Inspector (Mr. G. Lamb) submitted a report respecting the extension of the use of mechanical means of lighting and extinguishing the public gas-lamps in the city. This showed that 750 such instruments had been fixed, but not paid for; 7521 were required to complete the fixing throughout the city; and 50 were needed as spare ones (a total of 8321). The cost of fixing, at £132 per 1000, would be £1099; and the 8321 appliances, at £1 each, would make the total cost £9420. There would be a net saving of £1938 on the lamps, after paying interest and redemption. The reports were adopted.

Quality of London Water.—At the last meeting of the Metropolitan Water Board before the Christmas recess, the Water Examination Committee reported that the seventh report by the Director of the Water Examination (Dr. A. C. Houston) had been completed. In respect of the search for pathogenic microbes in the raw Thames water, the results were practically negative; but they went to show that a water might be excrementally polluted to a serious extent, and yet might contain none, or hardly any, of the microbes which actually cause epidemic water-borne disease. The Committee recommended that the report should be printed and placed on sale.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 21.

Sulphate of Ammonia.

During the past week there has again been a dull tone in the market for this material, and the buying has been somewhat of a hand-to-mouth description. There has continued to be a paucity of new orders from actual consumers; but, in spite of this fact, values have not given way appreciably, and at the close the quotations remain £14 2s. 6d. per ton f.o.b. Hull, £14 3s. 9d. per ton f.o.b. Liverpool, and £14 6s. 3d. per ton f.o.b. Leith. There is no change in the forward position; manufacturers maintaining their recent attitude, while dealers are reported to be taking business abroad for January-June shipment at about the equivalent of spot prices.

Nitrate of Soda.

This article is without alteration either in tone or value, and the quotations are repeated at 10s. 1½d. per cwt. for 95 per cent. quality and 10s. 4½d. for 96 per cent., for prompt delivery, *ex* store Liverpool.

Co-operative Local Advertising.—In the "JOURNAL" for the 12th inst. (p. 775), we gave a good example of what may be done by co-operation in the local advertising of gas. The "Surrey Leader" for the 15th inst. contains another, which is the result of the combined efforts of the Redhill and Horley Gas Companies. We learn that this advertisement has appeared for nearly twelve months. It is effective, and doubtless has brought business to one or other of the Companies; but the advertisement reproduced a fortnight ago was specially noticeable from the fact that a subject which was then engaging a great deal of public attention—that of national insurance—was made the vehicle for emphasizing the value of gas as a labour-saver in the kitchen.

Publication of Gas Coal Prices at Salford.—Owing to his absence in Scotland on business, Mr. Bratherton was not able to be present at the last meeting of the Salford Town Council to move a resolution, of which he had given notice, regarding the publication, in the *agenda* of the Council's proceedings, of the prices of coal and cannel purchased by the Gas Committee. In a telegram withdrawing the resolution, Mr. Bratherton reserved the right to bring it up at the next Council meeting. The resolution is as follows: "That it be an instruction to the Gas Committee that in future the prices of coal and cannel be published in the *agenda* of the Council's proceedings, and that no bargaining be permitted with any of the respective contractors after the tenders have been opened, any resolution of this Council to the contrary notwithstanding; and that such an intimation be inserted in every advertisement, together with the request that rock-bottom prices must be stated on all tenders or offers submitted."

The "FLETCHER"

Gas Cookers and Gas Fires

will ensure

Comfort and Contentment during the Weather Changes of This Yuletide Season

to Yourselves and Your Consumers.

FLETCHER, RUSSELL & CO., LD. WARRINGTON, MANCHESTER, & LONDON.

COAL TRADE REPORTS.

Northern Coal Trade.

There has been a strong demand in the Northern coal trade, but shipments have been impeded by the delay of steamers through stress of weather. Prices are steady on the whole; but prompt supplies of fuel are difficult to get beyond the contract needs. Best Northumbrian steams are from 11s. 7½d. to 12s. per ton f.o.b., second-class steams are from 11s., and steam smalls are steady at 5s. to 6s. In the gas coal trade, there is a heavy inquiry both for and above the contract quantities; and the large output has been taken up very promptly. Prices are based on from 12s. 6d. to 12s. 9d. per ton f.o.b. for best Durhams; from 11s. to 11s. 6d. for second-class gas coals; and from 13s. 3d. to 13s. 6d. for "Wear specials." The exports of gas coals are still impeded by the high rates of freight to the Italian ports; but as stocks there are believed to have been reduced considerably, it is expected that fuller shipments will be sent after the holidays. In the meantime, the home users desire to accumulate stocks of coals, as the labour prospect is uncertain, to say the least. Coke is firmer. Though the production of gas coke is now very heavy, the price is firm at 14s. 9d. to 15s. 3d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

The market closes for the year very strong for all sorts. Orders in advance are plentiful, and there is, consequently, every appearance of brisk trade. Prices now quoted are: Ell, 11s. 9d. to 12s. 6d. per ton f.o.b. Glasgow; splint, 12s. 6d. to 12s. 9d.; steam, 11s. to 11s. 3d. The shipments for the week amounted to 349,251 tons—an increase on the previous week of 6346 tons, and on the corresponding week of 13,533 tons. The total shipments for the year amounted to 16,034,752 tons—an increase of 111,887 tons on the preceding year.

Fatality to a Bristol Plumber.—William Hill, an aged Bristol plumber, was sent for by the tenant of Ashley Grange to find a leakage of gas near the main road. The same evening he was discovered, by two fitters in the employ of the Gas Company, in a trench he had dug, about 3 feet deep, in an unconscious condition, overcome by the gas. He was conveyed to the Royal Infirmary; but life was extinct.

Bilston Gas Company.—The report of the Directors of the Bilston Gaslight and Coke Company, to be submitted to the annual meeting on the 1st prox., states that the profit and loss account, after paying the usual interim dividends, shows a credit balance of £8505. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, and 4s. per share on the "B" shares (making, with the interim dividends, 11s. and 8s. per share respectively for the year), leaving a balance of £5820. During the year, the renewal of the second half of the retort-bench has been completed. Of the expenditure incurred thereon, £441 has been placed to capital account, £904 has been carried to suspense account, and the balance of the expenditure is included in the revenue account under the head of repairs and maintenance.

Islington Public Lighting.—The Islington Borough Council have received a letter from the Gaslight and Coke Company stating that they are prepared to submit a scheme for the installation of inverted burners in the gas-lamps in the borough, and suggesting that the Lighting Committee should first inspect the street lighting in other districts. It was decided to inform the Company that if they submit a scheme it would be fully considered.

A Wrongful Gas Connection.—Henry Tebbs, a plumber, was charged by the Nottingham Corporation, under the Gas-Works Clauses Act with laying, or causing to be laid, a connection to a gas-pipe, contrary to the regulations. The evidence showed that defendant had made a connection to the pipe leading to the meter in such a way that the gas supplied to two burners was not registered. It was pointed out that he had rendered himself liable to a penalty of £5, with an additional £2 for each day the connection was fixed; but the Corporation, while desiring to give a general warning, did not press the case to the point of asking for the maximum punishment. The defendant stated that, as soon as he found the connection had been improperly fixed, he offered to pay for the gas consumed by the two burners. A fine of 40s. was inflicted.

Tenders for Monazitic Sands in Brazil.—The "Financial Times" states that the Federal Government of Brazil invite public tenders for the exploitation of the monazitic sands lying in marine lands of the Union; tenders to be received in Brazil and in Treasury Delegation in London within the period of three months, computed from the date of the notice—that is to say, up to Feb. 4, 1912, at 2 o'clock in the afternoon, by letters closed and sealed, dated and signed, with the quantities and amounts expressed in figures and in full, and accompanied by proofs of the qualification of the competitors under separate cover also closed, and containing the acknowledgment of the deposit made at the General Treasury of the National Treasury (Thesouraria Gerel do Thesouro Nacional) for the amount of ten million reis. The contractor will be required to establish in Brazil a factory having a maximum capacity of production of 200 tons of nitrate of thorium per annum.

Birmingham Fitters and the Gas Department.—It is reported that the old-standing grievance between the master gas-fitters of Birmingham and the Gas Department, with reference to the various phases of municipal trading as affecting their particular trade, has at length been settled. Negotiations between the Masters' Association and Mr. R. S. Hilton, the Secretary of the Department, have resulted in the fitters obtaining concessions which will considerably improve their volume of trade. Arrangements have been entered into whereby the members of the Association will be appointed as "authorized gas-fitters to the Gas Department;" and all prices in connection with the work entrusted to them will be arranged between the Department and the Association. The terms are regarded as really an extension of the arrangement in force for many years, under which the Department employed master men to do their work; and the agreement will not retard the sale of fittings, &c., by the Department.

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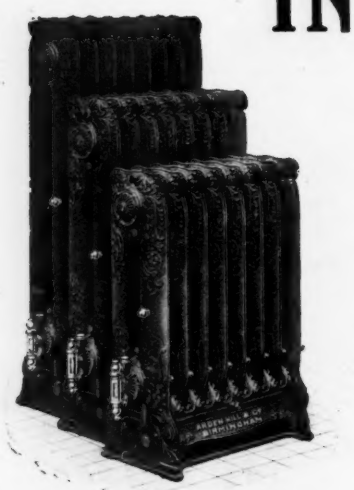

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Co-Operative Water Project in New Jersey.

The following particulars of a rather unusual co-operative project for the supply of water appeared recently in "Engineering Record": In the more thickly peopled districts about large cities, the existence of numerous small independent communities has frequently proved an obstacle to the execution of works for water supply and sewerage in the most economical and efficient way. Population and topography rather than political boundaries should be considered in such work; and yet people are so accustomed to confining their views of local public affairs to individual communities, that the idea of district co-operation is still somewhat strange. But it is evident that such co-operation is rapidly becoming necessary in some parts of the country. For example, the problems of water supply of a number of communities in New Jersey, in the vicinity of New York City, have reached a rather complicated condition. Some of them are supplied by a private Water Company, either directly or through subsidiary Companies; and the continued existence of this Company as a purveyor of water is open to question, though its life as a water power company is assured. The Company is a good example of what a private corporation can accomplish in the way of furnishing a wholesome supply to many communities. They are much dissatisfied on one account or another, however, mostly without any justification, and are looking for other supplies. Some of the communities in this section need additional water; a few of them have an ample supply, but it is costly. There is plenty of water available for all who want it; but the cost of collecting and delivering it is bound to be high unless the communities co-operate in the work. An opportunity for such co-operation has been afforded by the State Water Supply Commission, which is permitted under a recent law to make a contract with any municipality for a water supply, provided the municipality will advance the funds for the purpose to the Commission, and the latter consider the project advisable. By taking advantage of this law, eight of the Municipalities in this section, including places as large as Newark, Elizabeth, and Paterson, have asked the Commission to furnish information regarding the cost of a co-operative supply. The Consulting Engineer of the Commission (Mr. Morris R. Sherrerd, of Newark) has submitted a report on the project, which shows that water can be obtained at prices ranging from $25 to $43 per million gallons, depending upon the amount desired, and the pressure at which the supply is delivered. The engineering details of this project are interesting, since they include two systems—one a low-level project, yielding from 75 to 80 million gallons daily, if so much is needed; and the other a high-level project, yielding 15 million gallons daily. These works would prove a good investment for most of the communities, if the various towns handled their financial affairs in the same manner as those of Newark, for example, have been managed. That city pays at present about $36 per million gallons of water delivered into its reservoirs within the city limits. Most of this charge is for interest and sinking fund expenses, and will be almost eliminated within ten years; so that after this period the cost per million gallons will be greatly reduced. If the same management is applied to this co-operative project, the charge for the water to the participating Municipalities would be greatly reduced as the bond issues become amortized.

A Promising Preference Share Investment.

A promising little undertaking is that of the Mundesley and Holt Gas Company, Limited, who are now issuing 6000 preference shares of £1 each, entitled to a dividend of 5½ per cent. per annum in priority to the ordinary shares. If there were no other information available than the names of the Board of Directors, we should feel perfectly justified in recommending this issue as an investment. The Directors are all men of experience and position in the gas industry—Mr. Henry Woodall, of Palace Chambers, Westminster, Mr. Thomas Glover, of Norwich, Mr. W. A. Surridge, Chairman of the Herne Bay Gas Company, and Mr. F. R. Smith, whose interests in the gas industry are practically lifelong. The towns supplied are situated in Norfolk; and the owners of the works have agreed to accept the whole of the ordinary shares of the new Company in payment of all money expended on the properties. The price to be paid by the Company to the vendors (who are the promoters) is £6000, which, as said, is all payable, save as to £7 preference shares, in ordinary shares—the sum representing actual money advanced, with 5 per cent. simple interest from date of payment. No part of this consideration is in respect of goodwill. The profits last year would have been sufficient to meet the dividend on the present issue, and would also, after making adequate allowance for repairs and maintenance, have provided a dividend on the ordinary shares, and allowed a balance to be carried forward. The output of gas in both towns is increasing at a rapid rate.

Public Auditor and the Gas Finances of the Thornton Urban District Council.—In a report addressed to the Chairman and members of the Thornton Urban District Council, Mr. Noel M. Griffiths, the Government Auditor, says, with reference to the accounts, that, with the idea of keeping the rates down, a policy has been pursued which bears on the face of it the stamp of unsound finance. He points out that the balance to the credit of the general district fund on April 1, 1910, was £127; but that the year closed with a debit balance of £2 10s., after writing off £433, the loss on the gas undertaking for the previous year. Having shown that the net loss of £616 on the gas undertaking requires to be charged to the district fund during the current year, that the borrowing powers for gas purposes have been exceeded by £139, and that the Treasurer has overdrawn on the general revenue account to the extent of upwards of £800, Mr. Griffiths says the future will prove that the interests of the district are more truly served by placing the finances on a sound footing, so that unexpected expenditure may be met without undermining the financial stability rather than by paying undue attention to the popular cry of "low rates."

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South Lincolnshire Water Supply.—According to a paragraph in the Engineering Supplement to "The Times," terms have been agreed upon between the Receiver for the South Lincolnshire Water Company and the Spalding Rural District Council for the purchase of the works of the Company, so far as they concern the Spalding rural district. These works include an artesian well at Pinchbeck West, 212 feet deep, yielding 50,000 gallons of water per hour, and the mains between the borehole and Holbeach, so far as they have been laid, though the purchasers will have to complete the break in the line of pipes where it is proposed to cross the River Welland. The terms of the purchase have not been made public; but the original price asked by the Receiver for the whole, including the mains from Spalding to Sutton Bridge, was £12,000.

The tenders for converted ordinary stock of the Shrewsbury Gaslight Company recently advertised for in the "JOURNAL" were opened last Tuesday, when stock amounting to £8498 was applied for. Tenders amounting to £5181 were accepted at prices varying from £127 5s. to £126; and tenders amounting to £3317 at £126 and below were unsuccessful. The average price realized was a fraction more than £126 10s. per £100.

A social gathering of the Contractors to the Engineers' Department of the Scottish National Exhibition was held on the evening of the 16th inst., in the Alexandra Hotel. Mr. A. C. Freeman, the Chief Engineer to the Exhibition Executive, and his assistants (Messrs. A. D. Smith and J. W. Stevenson) were the recipients of tokens commemorating the good fellowship that existed between the department and the Contractors. Mr. J. Richard Milne, of Messrs. James Milne and Son, Limited, was in the chair. It will be remembered that the latter firm carried out the main high-pressure lighting contract in connection with the exhibition.

The Mercédès Gas Syndicate, Limited, has been registered with a capital of £2500, in £1 shares.

The Vertical Gas-Retort Syndicate, Limited, intimate that a further order has been received for Dessau verticals—namely, three furnaces, with eighteen 4-metre retorts, or 54 retorts, for Kyoto (Japan).

Judgment was given in Glasgow last Wednesday in the Board of Trade inquiry into the loss of the steamship *Princess Patricia* off the island of Arran, in the Firth of Clyde. The Court found that the stranding of the vessel could only be explained on the theory that the compass was deflected by an electric lamp in the look-out man's pocket while he was standing on the bridge 3 feet away. It was added that, owing to the difficulties of the question, it was impossible to throw any blame upon the navigating officer.

The current number of the "Co-Partnership Journal" of the South Metropolitan Gas Company is accompanied, as usual in the case of the last issue for the year, by the "Co-Partnership Almanac" for the following year. The top portion of the centre of the sheet is appropriately occupied by a reproduction of a photograph of the statue of Sir George Livesey, by Mr. F. W. Pomeroy, A.R.A., which was unveiled by Earl Grey on the 8th inst. Beneath it is the Directors' message to the employees. They express their pleasure that the amount of money invested by the co-partners continues to increase; their holding of ordinary stock being now £301,490. In congratulating them upon this gratifying result, the Directors take the opportunity of wishing them and those dear to them "A Happy New Year." Under the message is a brief chronicle of the Company's co-partnership; on the left are the names of the Co-Partnership Committee; and on the right a list of co-partnership gas companies. The calendar contains a large number of interesting entries, not only in connection with the South Metropolitan Gas Company, but with the gas industry generally, and events bearing upon it and upon scientific progress.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.

COLLECTOR-REPRESENTATIVE. Dorking Gas Company. Applications by Jan. 3.
WATER GAS MANUFACTURER, &c. Devonport Gas Department. Applications by Jan. 1.
WORKING MANAGER (Water Company). No. 5498.

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NEWTOWNARDS GAS DEPARTMENT. Tenders by Jan. 18.

Hydrants, Stopcocks, Ferrules, Valves, Cast-Iron Work, Lead, &c.

PLYMOUTH WATER DEPARTMENT. Tenders by Jan. 11.

Tar.

HARWICH GAS AND COKE COMPANY. Tenders by Jan. 6.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1912, are reminded that this can only be done during January.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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[REGISTERED AS A NEWSPAPER AT THE G.P.O.]

VOL. CXVI. No. 2537.] LONDON, DECEMBER 26, 1911. [63RD YEAR. PRICE 6d.

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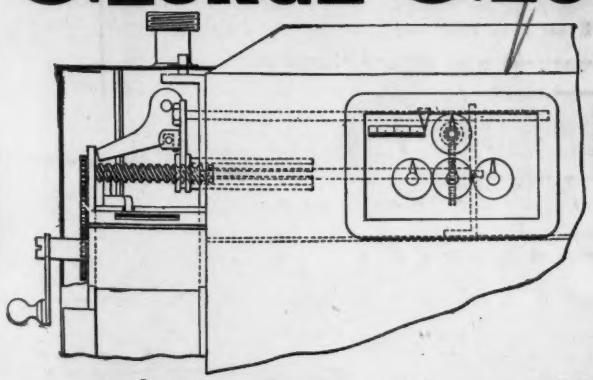

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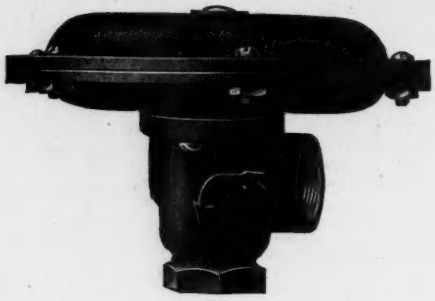

Fig. 568.

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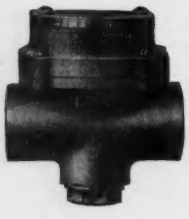

Fig. 618.

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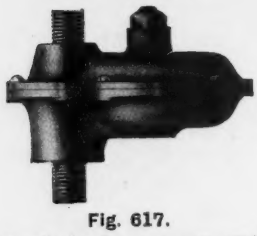

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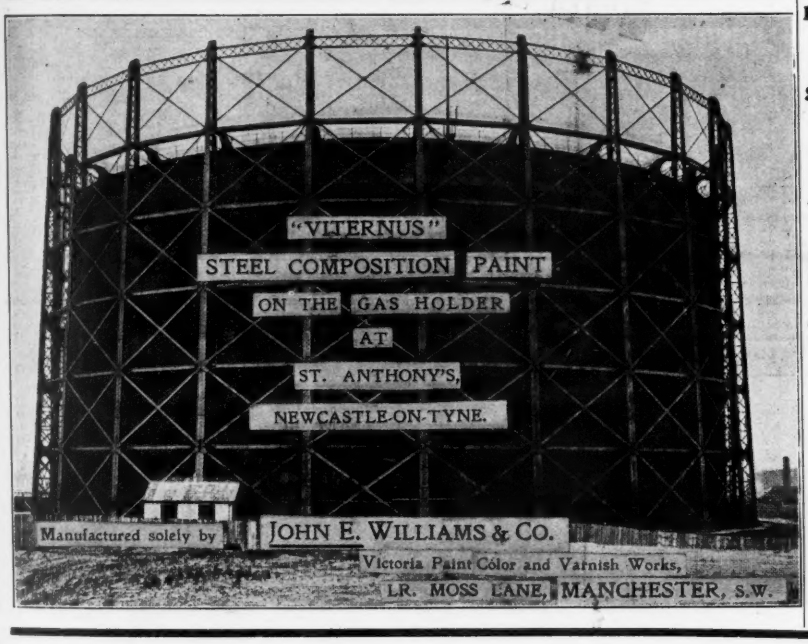

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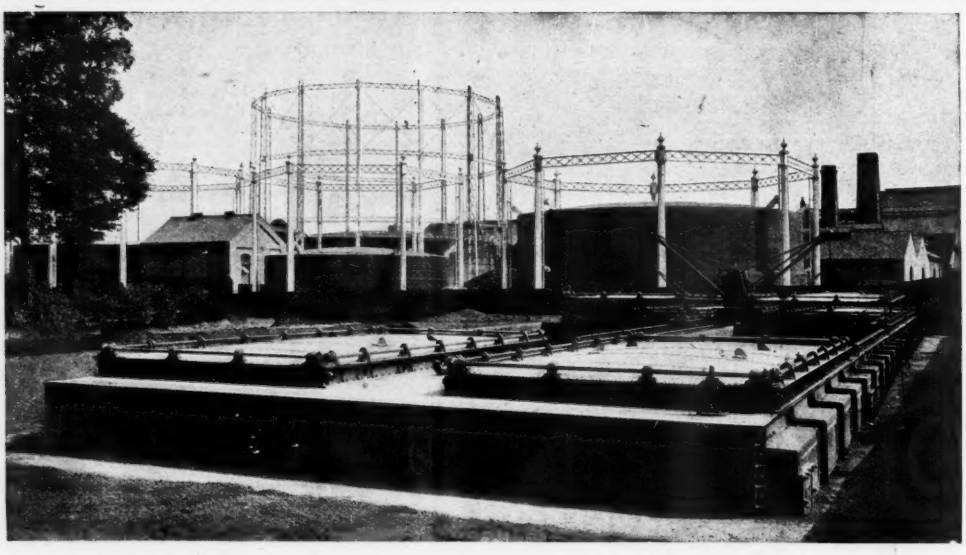

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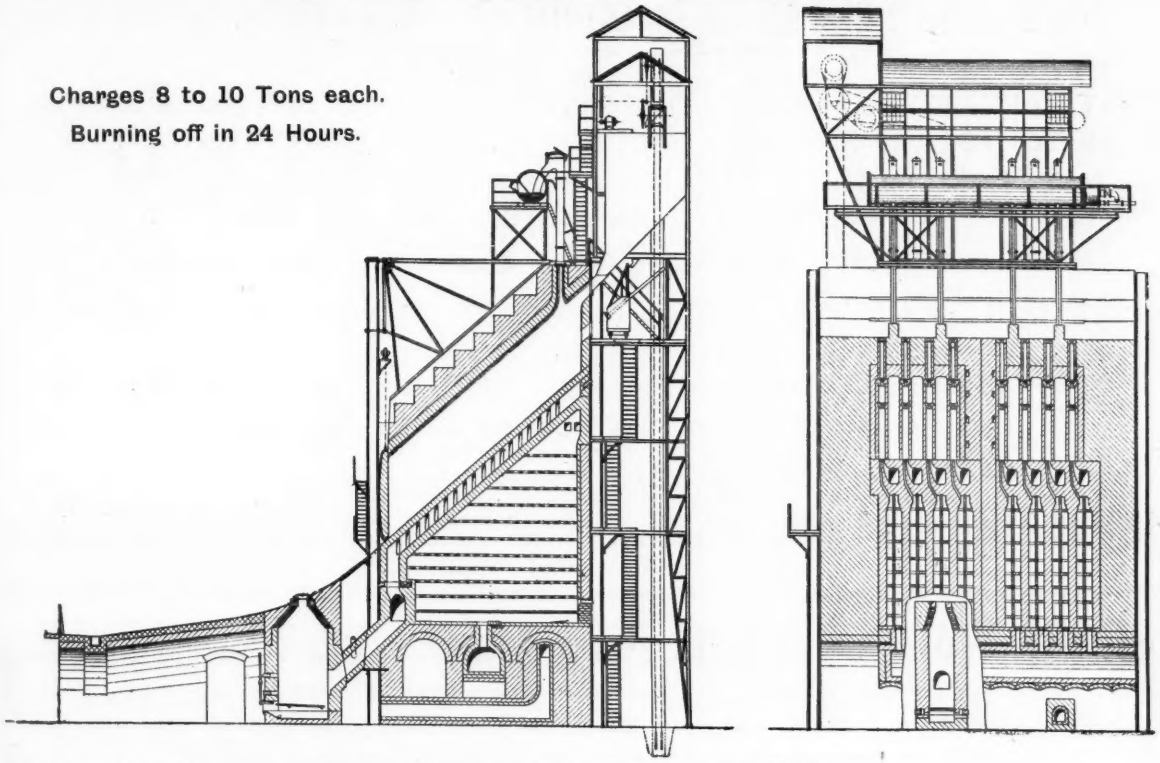

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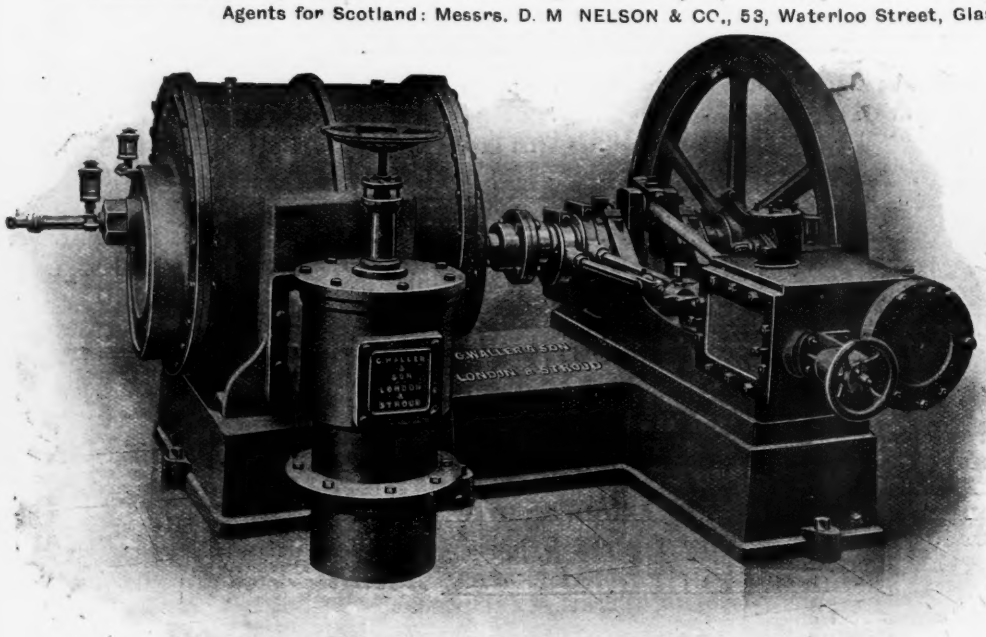

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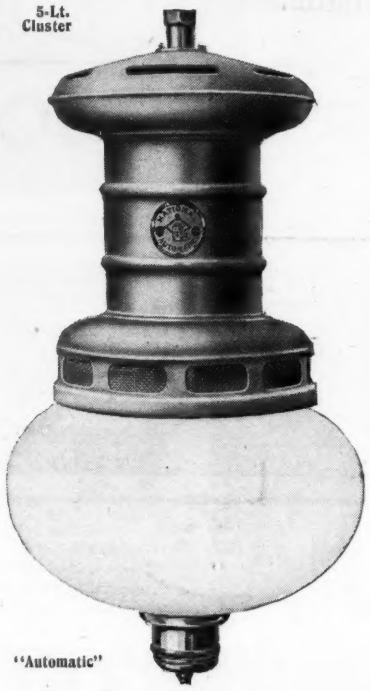

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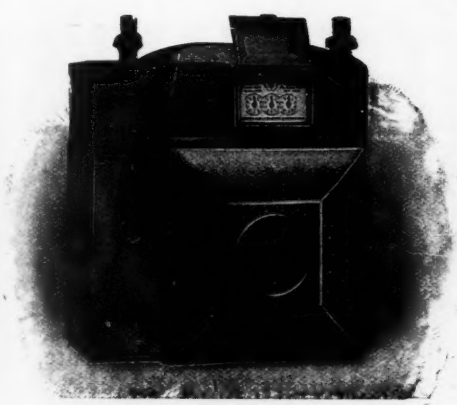

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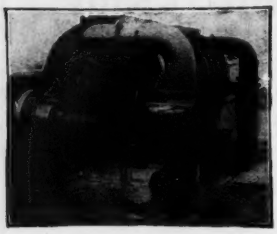

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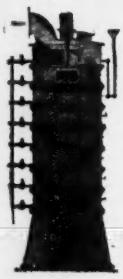

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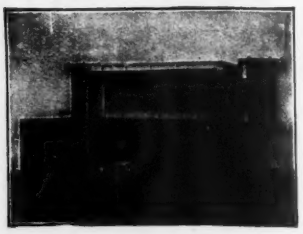

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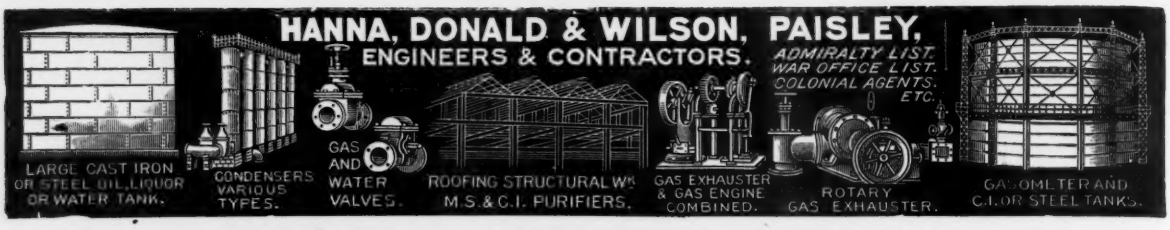
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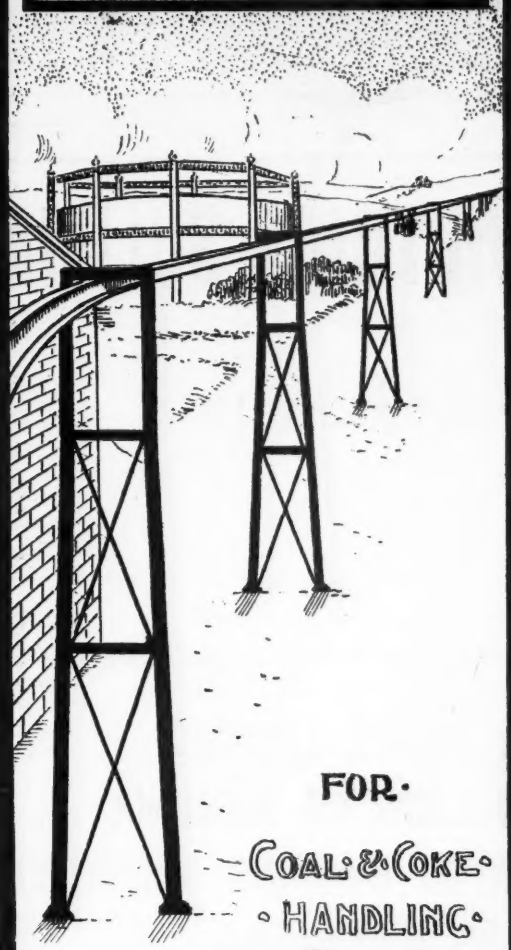

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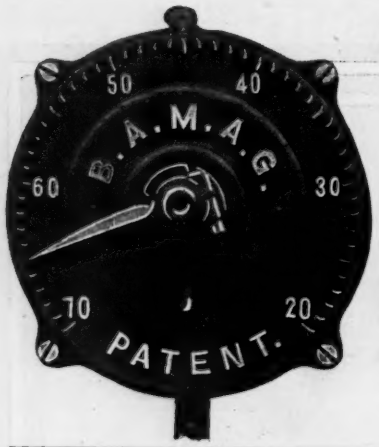

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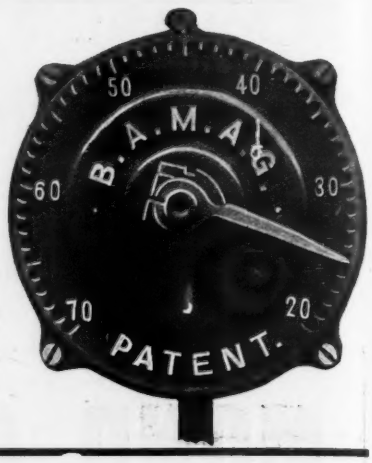

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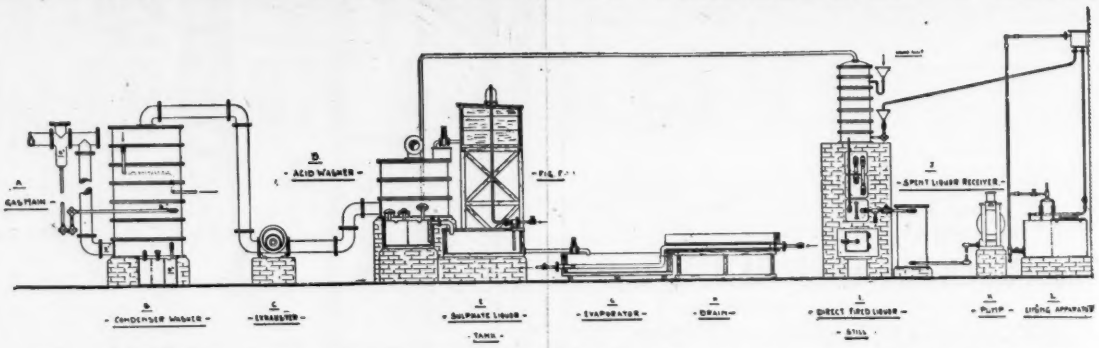

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BOOKS for Sale, cheap—Three Years' "JOURNAL" 1906, 7, and 8, Unbound. Twenty-one Years "GAS INSTITUTE TRANSACTIONS"—1888 to 1908. Thirteen Years ASSOCIATIONS REPORTS 1896 to 1908. Perfect Condition. Best offer to clear.
Apply 14, Bridge Street, Swindon.

CHEMICAL Plumber and London Lead- burner, with Sound Practical Knowledge of Saturators and the Like. References from Leading Firms. Any distance. Rate 11d. per Hour Constant, or 1s. Temporary, Employment, with Fares.
Address No. 5492, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ENGINEER (Age 35) Representing Gas-Plant Engineering Firm of First-Class Reputation for past Two Years, Trained, Electrical and Mechanical, with Seventeen Years' Practical, Technical, and Commercial Experience, and a good knowledge of Gas and Colliery Engineering, seeks similar POSITION with good Firm.
Address No. 5493, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WORKING Manager wanted to Take CHARGE of District for Rural Water Company. Work will include Collection of Rates, General Supervision of Pumping Plant, Mains, Main and Service Laying, Waste Prevention, &c. Experience in such work essential. Must be good Cyclist. Commencing Salary, £91 per Annum and allowance of £5 per Annum for use of Cycle.
Apply, by letter, giving full Particulars of Experience, to No. 5498, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, A Collector-Representa- tive to do the whole of the Company's COLLECTING, and, as opportunity occurs, CANVASS or new Business.
Preference will be given to one holding a Certificate in "Gas Supply." Age 25 to 35 years. Salary, £120 per Annum, with an increase of £4 per Annum for each additional One Million Cubic Feet Maintained Increase in the Company's Sales of Gas up to 10 Millions. The Salary will then be reconsidered. Further Particulars on Application.
Applications, with not less than Two Testimonials, to be sent addressed to the undersigned not later than the 3rd of January, 1912. General Manager, Gas Company, Dorking.

COUNTY BOROUGH OF DEVONPORT.
(Gas Department.)

THE Gas Committee require the Ser- vices of a Competent Man to SUPERVISE the Manufacture of Carburetted Water Gas under the Direction of the Engineer. Cutler's Plant is in use. Preference will be given to one who has had Practical Experience and Previous Control of this type of Plant, and is able to carry out all Repairs to the Machinery.
Wages, £2 per Week.
Applications, endorsed "Operator," stating Age and Experience, addressed to the undersigned, must be Delivered not later than Monday, Jan. 1, 1912.

W. P. Tervet,
Engineer and Manager.

Gas-Works, Devonport,
Dec. 18, 1911.

WANTED—Good Modern Second- Hand RETORT BENCH IRONWORK for Horizontals, with or without Mouthpieces.
Particulars to No. 5495, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

EXHAUSTER AND STEAM ENGINE Combined. Geo. Waller and Co.'s latest Three-Blade Type. 7-inch Valves, 10-inch Bye-Pass. Perfect Condition. Nearly new. Cheap to clear.
Firth Blakeley, Limited, Church Fenton, Leeds.

KIRKHAM WASHER-SCRUBBER, with 8-inch Valves and Connections Complete. Cheap for Immediate Sale. Recently fitted with new Grids.
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NEWTOWNARDS URBAN DISTRICT COUNCIL.
(Gas Department.)

TENDERS FOR SPIRAL-GUIDED GASHOLDER, &c.

THE above Council are prepared to receive TENDERS for the Supply, Delivery, and Erection of a SPIRAL-GUIDED GASHOLDER, STEEL TANK, and CONNECTIONS.
Specifications, General Conditions, and Form of Tender may be obtained, along with any other Particulars required, from Mr. W. H. Roberts, Engineer and Manager.
The Council do not bind themselves to accept the lowest or any Tender.
Tenders, marked "Gasholder," to be addressed to me, and will be received up to Twelve o'clock Noon on Thursday, the 18th day of January, 1912.

H. M'Cartney,
Clerk to the Council.

Town Hall, Newtownards,
Dec. 16, 1911.

PLYMOUTH CORPORATION WATER-WORKS.

TENDERS are invited for the Supply of the following GOODS and MATERIALS for a Period of One Year:—
FIRE-HYDRANTS.
LEAD PIPE AND PIG LEAD.
STOPCOCKS, FERRULES, &c.
CAST-IRON WORK.
SLUICE VALVES.
Particulars and Forms of Tender can be obtained at this Office on and after Dec. 30, 1911.
The lowest or any Tender will not necessarily be accepted.
Tenders, Enclosed in Envelopes Provided, to be Delivered at this Office by Twelve o'clock Noon on Thursday, Jan. 11, 1912.

Frank Howarth, M.Inst.C.E.,
Water Engineer.

Municipal Buildings,
Plymouth.

TENDERS FOR GAS COAL.

THE Lighting Department of Copen- hagen are prepared to receive TENDERS for the Supply and Delivery of about 210,000 Tons Best GAS COAL from the beginning of March until the end of December, 1912.
The Lighting Department reserve the right to divide the Contracts between Two or More Contractors.
Further Information and Conditions for the Delivery may be obtained on Application to "Direktoren for Kobenhavns Belysningsvaesen, Raadhuset, Copenhagen, B."
The Tenders, Sealed and Marked "Tilbud paa Kul," to be sent to "Direktoren for Kobenhavns Belysningsvaesen, Raadhuset, Copenhagen, B.," before the 10th of January, 1912, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties Tendering who are in Attendance.

The Lighting Department of Copenhagen.
Dec. 18, 1911.

HARWICH GAS AND COKE COMPANY.

TENDERS are invited for the Surplus TAR produced at the Company's Works for the Year ending Dec. 31, 1912.
The Tar will be Delivered free into Railway Tank Waggons or Tank Barges at the Works.
Probable quantity, 120 Tons.
The Directors do not bind themselves to accept the highest or any Tender.
Sealed Tenders to be Delivered addressed to me not later than the 6th day of January, 1912.

Geo. Baines,
Secretary and General Manager.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

MITCHAM AND WIMBLEDON DISTRICT GASLIGHT COMPANY.

NOTICE is Hereby Given, that a SPECIAL GENERAL MEETING of the Proprietors of the Mitcham and Wimbledon District Gaslight Company will be held at Caxton Hall, Caxton Street, Westminster, on Tuesday, the 16th day of January, 1912, at Three o'clock in the Afternoon for the purpose of submitting for the consideration and approval of the Proprietors of the said Company then present in person or by proxy a Bill as introduced, or proposed to be introduced, into Parliament in the ensuing Session intituled "A Bill for Amalgamating the Wandsworth and Putney Gaslight and Coke Company, the Mitcham and Wimbledon District Gaslight Company, and the Epsom and Ewell Gas Company, and for other purposes."

Dated this 21st day of December, 1911.

B. R. GREEN, Secretary.

Company's Offices, Western Road, Mitcham.

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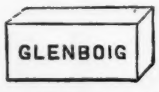
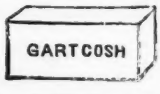
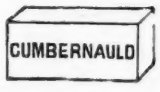
Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS.



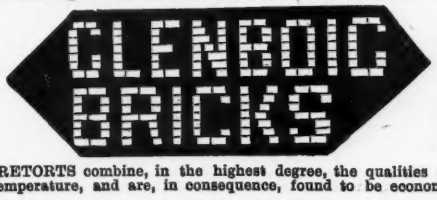




The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.



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Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

28, Leadenhall Street,
London, E.C., September 21st, 1909.

Dear Sirs,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·7 %
" " " 1050° C.	4·7 %
" " " Total	8·46 %
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. 3362° F. (SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

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ARTESIAN BORED TUBE WELLS,

Norton's Patent "Abyssinian" Tube Wells.
Deep Well Pumps and Patent Air Lift Pumps.

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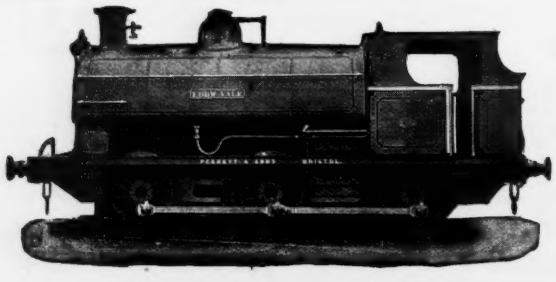

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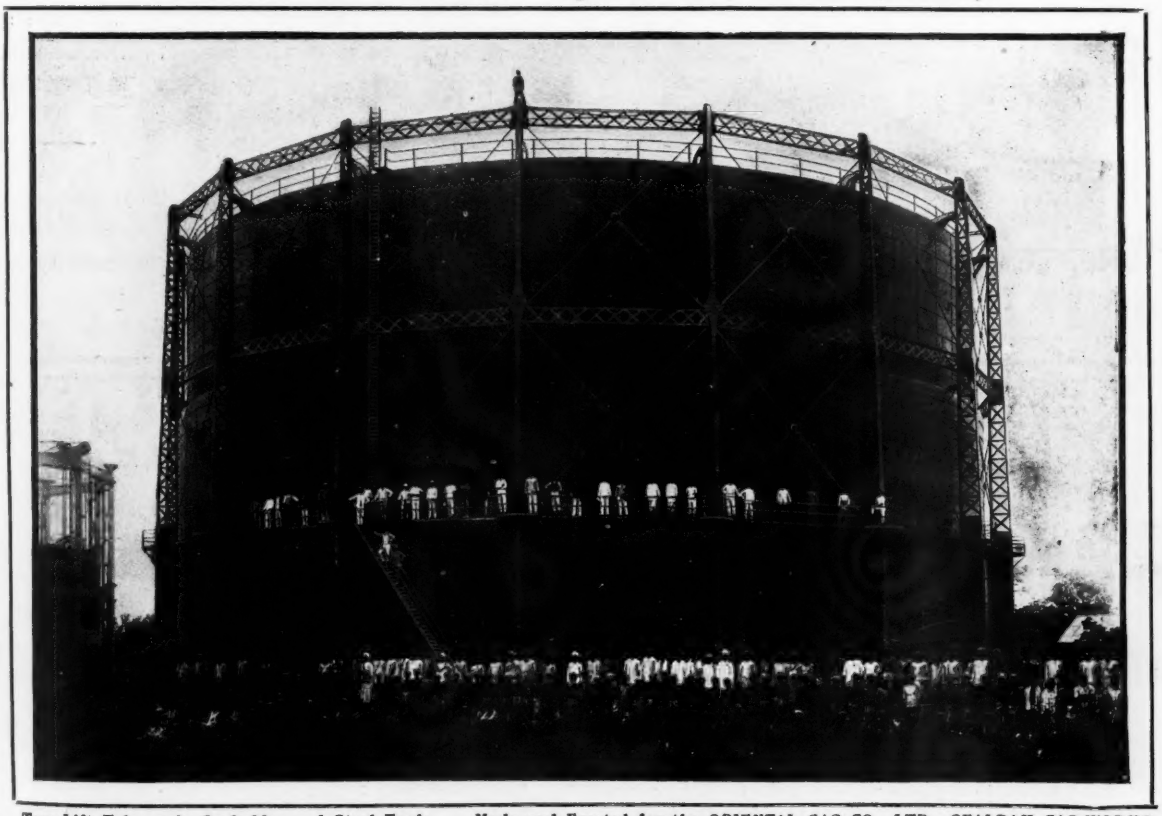

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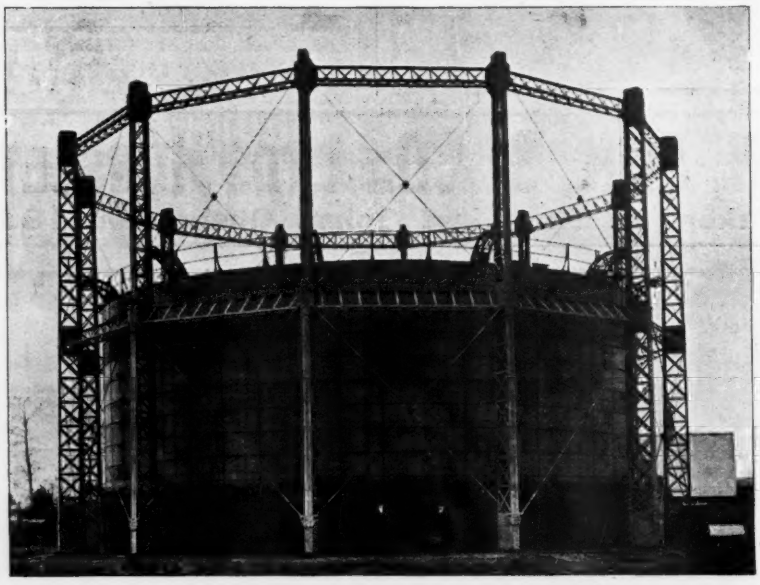

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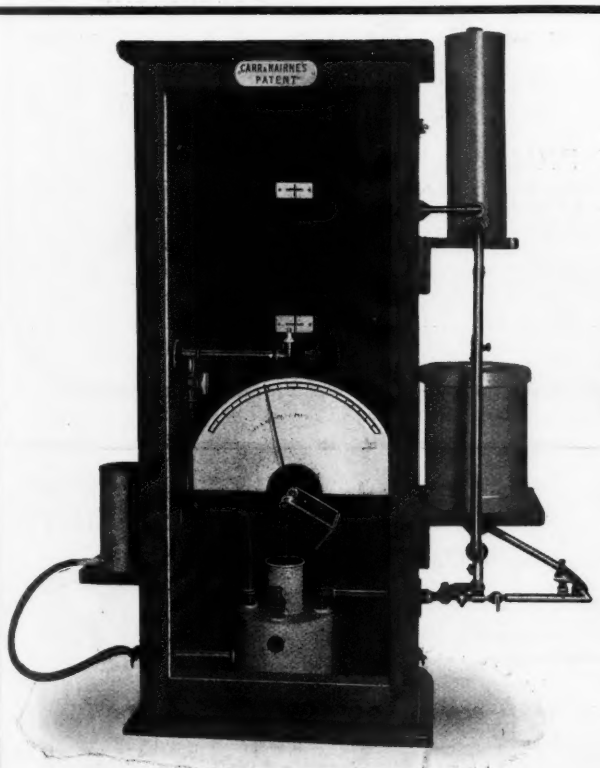

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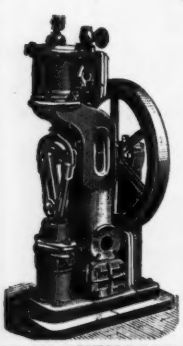

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 596. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

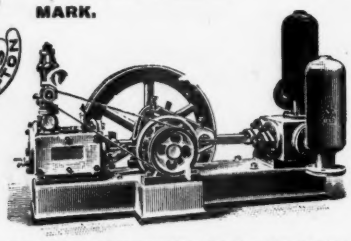

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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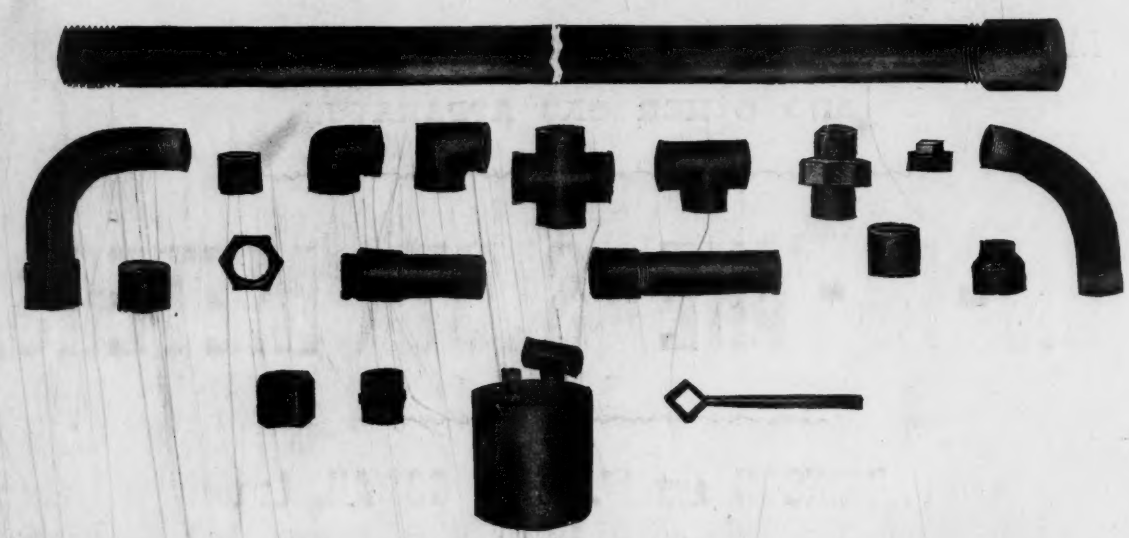

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Printed and Published by Walter King, at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 26, 1911.